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Vessels not Named.

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The Marine Engineer
And Naval Architect.
LONDON, AUGUST 1, 1907.

THE NAVIES OF THE GREAT POWERS

At the end of last month the Home Fleet, the latest development of the many reforms and reorganizations which have been carried out by the Board of Admiralty. was mobilised and brought up to war strength. After a week of exercise and practice this force was brought into the Solent, where, on the 3rd of this month, it will be reviewed by the King. Upwards of two hundred pennants will be flying, and as a reserve of the British Navy it is indisputably unmatched by anything of the kind previously in existence. It must be unnecessary to remind the readers of this journal of the state of things, in regard to the reserve, which ruled in past years. We need not go back to that curious collection of old crocks which was got together in 1885, as an evolutionary squadron, under the late Sir Geoffrey Hornby, in view of the possibility of war with Russia, although it was then that the eyes of the country were first opened to the urgent need for increasing the fleet and forming an effective reserve. But although very much has been done to supply the national requirements in regard to these matters since that date, there have always been, as those who have followed the course of naval affairs must be aware, grave faults to be found with the system which was being slowly evolved. Year by year mobilization of the reserve took place, but with the result that, although crews were put into the ships which filled the basins of the fleet reserve and these vessels were taken to sea, the fact that the officers and men were new to the ships, and that the ships themselves were but inefficiently looked after in the yards, produced a lamentable crop of defects. About three years ago the plan of providing the best of the reserve vessels with small nucleus crews gave promise of a better result; the nucleus, however, was found by experience to be too small, and as a consequence the scheme which supplied the Home Fleet has taken its place. The Home Fleet consists of three divisions, one—that which is based on the Nore, and has its training ground in the North Sea—contains the latest vessels in type with full crews. It is really in the proper sense of that much abused term an "instantly ready" fleet. The remainder of the effective vessels of the reserve are always supplied, in the case of the battleships and cruisers, with three-fifths of their crews, and in the case of the destroyers with four-fifths, so that it is possible in an emergency to fill up the crews of these ships with men under training, all acting service ratings, and send them to sea in a few hours. For ordinary purposes it is unnecessary to dislocate the training machinery at such short notice, and therefore a somewhat longer time is taken, but instead of weeks and months spent in preparation, our home guard is now ready to put to sea and become an effective weapon by the mere dispatch of a telegram from head-quarters. It is only necessary for the Admiralty to press the button, and the officers and men, who know their ships intimately, and are always in them, will do the rest.

It is essential in any consideration of the subject we are about to discuss that this matter of readiness for war should receive attentive study. A mere tabulation of figures showing that this Power or that has got so many more ships than another is not sufficient to give the reader any adequate idea of relative naval strength. Nor does it suffice to add up tons and guns and place these in juxtaposition; the organization for war, the distribution of fleets, and the full supply of the right kind of material for the complements of the vessels must also be weighed in the balance. In another column of this journal will be found some tables, based on the official figures published by the various Powers whose navies are under review. All obsolete vessels, vessels which it would be the height of folly to put into the line, have been eliminated. A distinction has also been made between those vessels which are of obsolescent type and those which are of later date; while in another table the vessels under construction and projected are added. From these figures, taken with the above reservation, some interesting comparisons and contrasts may be made. If, for example, we compare the present position of the Powers in the later types of effective battleships we shall see that Great Britain possesses eight more of such vessels than the United States and France together, and fifteen more than France and Germany have now. If to these figures we add the battleships under construction and projected we shall find that the United States and France have on paper two more ships than Great Britain, but as our vessels are in a much more forward state of construction, while theirs are, many of them, not yet laid down, this is precisely one of those cases where the facts do not square with the figures. If we continue only to lay down two battleships a year, and build them to the standard set by the *Dreadnought*, we can easily maintain our superiority. If, instead of the United States and France, we take France and Germany, our preponderance is still assured, and this whether we count ships, or tons, or guns. Turning to the armoured cruiser construction, whether of vessels actually effective at the present time, or with the addition of those under construction and projected, the balance is altogether in favour of Great Britain; indeed, here we have a strength superior to that of the other three Powers put together. In these circumstances it is surprising that there should be

any attempt at the present moment to raise a scare about what one of our contemporaries has had the temerity to style "A position of peril." This is crying wolf with a vengeance. The danger is not now, but it may come, and if it does it will be brought about by those who have forced the naval authorities in their own defence to reveal the strength of our position.

THE FIRST IRON SHIP.

THE controversy that has been going on of late with regard to the first ship built of steel calls to mind the building of the first iron ship. It was on July 14th one hundred and twenty years ago that the first iron ship was launched. One might naturally expect that some place such as on the Clyde, Mersey, Thames or Tyne would be where such an epoch-making event might occur; but it was on a little river called the Winster, in the north of Lancashire, that the success of iron for boat construction was first proved. About that time John Wilkinson, a celebrated ironmaster who belonged to that district, and who owned many works in Staffordshire, made many experiments with small boats on a small canal he had had built in the Cartmel mosses. When he discussed an iron boat with his friends the whole idea was ridiculed. They foolishly argued that no boat built of iron could float, for it was against nature's laws. Iron would not float itself, therefore how could an iron boat float? Wilkinson, however, designed his vessel, and when he launched her in the small waters of the stream which divides Lancashire from Westmorland he proved that his ideas were right. She floated lightly on the water, and, after being fitted up, was used on the Bradley Canal. There is some doubt as to what was her burthen, some saying that it was 70 tons and others 40 tons. A second ship was built for the river Severn. Wilkinson had a medal struck in commemoration of the event, on the obverse side of which was an iron ship in full sail. The first vessel was only a small one, but it was large enough to prove a great principle, and soon afterwards the discovery resulted in the construction of iron ships of greater size, and in the end we know that iron vessels superseded the old wooden ones, and now-a-days iron ships have been superseded by ships built of steel. Wilkinson, in a letter on the subject, said 999 people out of every thousand actively opposed his idea to build a vessel of iron.

John Wilkinson was a remarkable man in many ways. At one time he ruled the iron markets, and, apart from the designing of an iron boat, he did what in those days were considered remarkable things. Before the ship was built he had been interesting himself in the Paris waterworks, and he delivered to them no less than forty miles of iron piping. Paris gave a great banquet in his honour. That banquet was also on a July 14th. In later years he took out some patents for the steam engine on a July 14th, and, to crown all, he died on July 14th, 1808. His body was enclosed in an iron coffin which was made at one of his Staffordshire works.

At his home in North Lancashire, Lindale-in-Cartmel, a public monument of iron twenty tons in weight was erected to his memory, which at the present time is sadly in want of repair. There are no funds for the purpose of preserving this, and an appeal has been made. It would be regrettable if the memory of such a man as Wilkinson was to be allowed to fade and the monument to his genius fall and decay.

MARINE ENGINES.

WE illustrate in the adjoining diagrams some of the machinery manufactured by Messrs. T. A. Savery & Company, of Newcomen Works, Birmingham. In the first place Fig. 1 shows a quick-revolution triple-expansion marine engine which, with 175 lbs. working pressure and 350 revolutions

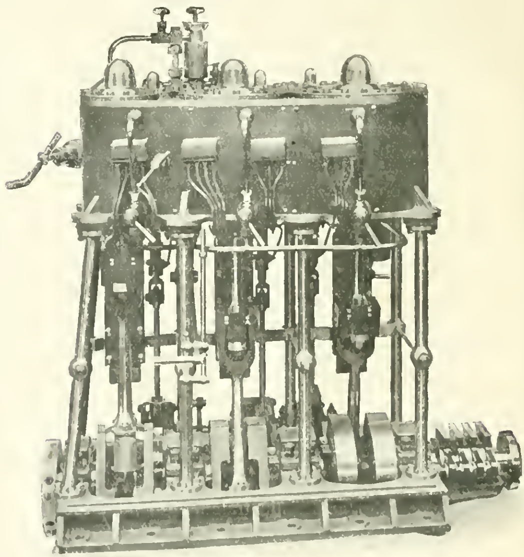


Fig. 1

per minute, will develop 80 indicated horse power. The valves are operated by valve gear of the Marshall type. Fig. 2 shows an engine of much smaller size, which is a compound condensing quick-revolution launch engine capable of developing 18 indicated horse power with a working pressure of 250 lbs. per

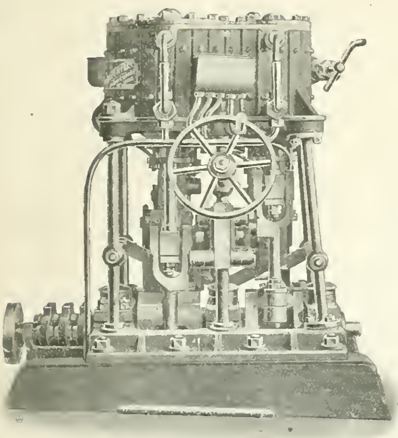


Fig 2

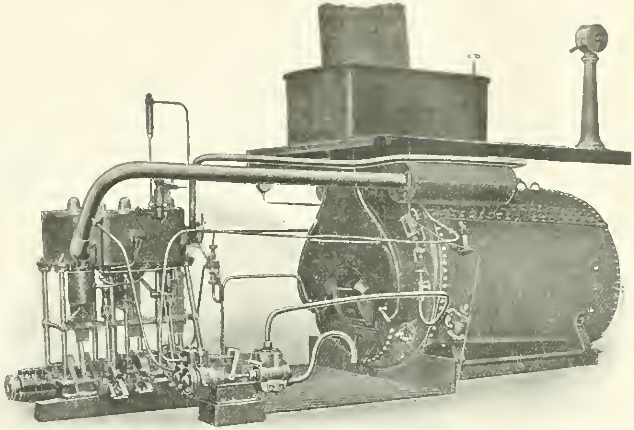


Fig. 4

square inch at 800 revolutions per minute. The diameters of the cylinders are 3 ins. and 6 ins. respectively, and the stroke is $3\frac{1}{2}$ inches. The valves in this engine are operated by the Savery-Joy valve gear.

Fig. 3 shows a side sectional elevation and a part sectional joint elevation of the engine illustrated in Fig. 2. This diagram shows the construction and arrangement of the valve and the mechanism for operating the same. It will be noticed that in this gear the slotted quadrant of the Joy valve gear is substituted by a radius rod pivoted at the end of a pivotable arm in a manner similar to the arrangement in the Marshall valve gear.

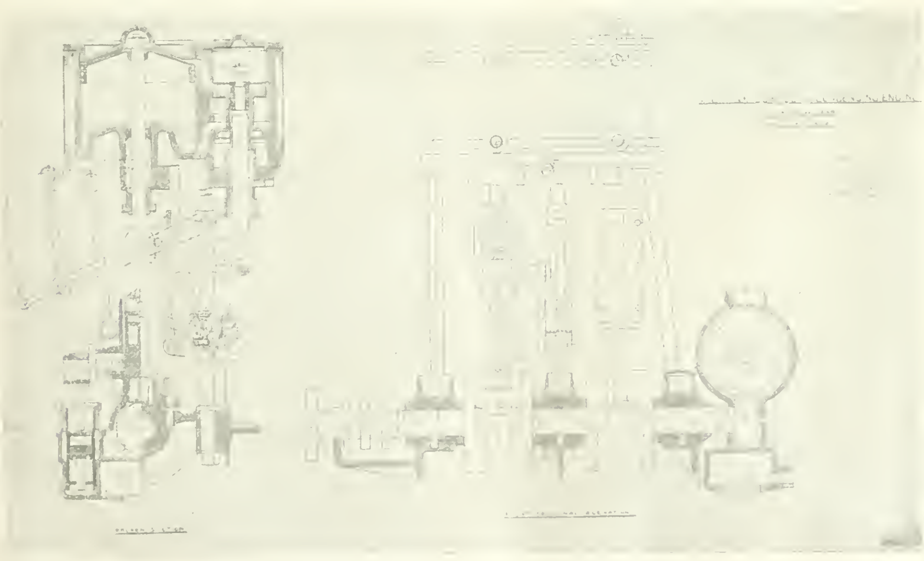


Fig. 3.

A further feature shown in Fig. 3 is a pump driven from the main crank shaft by worm and worm-wheel gearing.

In Fig. 4 we illustrate a complete set of quick-revolution triple-expansion machinery for a fast passenger steamer, for example, of 72 ft. length, 13 ft. 6 in. beam, 3 ft. 6 in. draught, and having a speed of 11 miles per hour. The engine will develop 80 indicated horse power at 350 revolutions per minute with 175 lbs. working pressure.

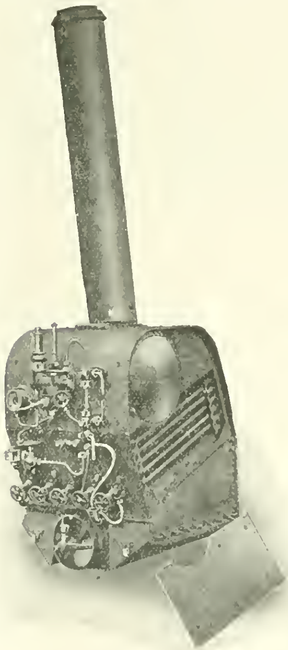


Fig. 5.

The installation is complete with feed pump, injector, telegraph, deck-starting gear, lowering gear for funnel and other accessories.

Fig. 5 represents a quick-steaming, straight-tube water-tube boiler for forced draught, and is made in sizes capable of giving from 6 indicated horse power to 80 indicated horse power. There are five distinct elements in the tube arrangements.

The Austro-Hungarian Government have contracted with Messrs. Yarrow & Company Limited, of Poplar and Glasgow, for the construction of two exceptionally high-speed shallow draught gunboats, propelled by internal combustion engines. These vessels are to be in all essential particulars similar to *Mercury II.*, which was purchased by the British Admiralty last year, and on board which, it will be remembered, the King and Queen took a trip during Cowes week.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

The "Lusitania."

I HAD the good fortune to be in Liverpool on Wednesday the 17th July, when the first of the new Cunarders was moved into graving dock for cleaning and painting. It was a sight never to be forgotten. The immense bulk of the ship gradually swung round the angle of the dock wall so as to bring her bows into the entrance of the great graving dock, which, by the sagacity and foresight of the Mersey Dock and Harbour Board, was ready for her reception, and which is more than sufficient to deal with even such a monster as she. Then she was straightened out and gradually—almost imperceptibly—brought to her proper station. To those who were watching from the dock wall her size was, of course, noticeable enough, for we had a means of comparison in the workmen who were running the hawsers, the officials who, megaphones in hand, were directing their operations, and the officers, far above us, signalling to one another and to the shore. Her bow is a remarkable one. The fineness of her entrance, coupled with her great flare, gave one the idea of a Kropp razor—with a keen flat edge to the blade, a curving to a heavier back, so that an idea of immense strength was conveyed to the mind, as well as the all-prevalent one of vast speed. Aft the above-water lines of her stern are singularly beautiful and attractive. She was drawing about twenty-nine feet forward when she came into dock, and there was a great space between the water line and the Board of Trade load line. Yet even above that there was a vast freeboard at the bows. But if a vessel even of such dimensions as the *Lusitania* is to maintain a speed of five-and-twenty knots against the might of Atlantic waves, she must be prepared to take head seas in volume over her bows, and the means provided for dealing with such eventualities are remarkable enough. The plating is carried to the top of the deck house in the fore part of the super-structure, and the protection for bridges and upper decks is thus not only of great strength forward for the resistance of a direct attack, but is also arrayed for the meeting of more insidious blows from several points on the bows. Having seen the dock gates closed and the work of setting the shores in place commenced, I went off on other business, thinking that on the following day one would be able to see the under-water lines of the racer and to examine the design of the rudder and the arrangement of the four great screws which are to force the ship through the water with the force of 17,000 h.p.—considerably more than the entire power of the Company's once record-breaker *Umbria*—for each propeller. What, then, was my astonishment to hear certain startling rumours later on in the evening. I hardly believed them, though they seemed to have attained a certain credence in some Liverpool editorial offices, but I thought I would visit the ship again—for she exercises an indescribable fascination, not only for myself, but for every one interesting in shipping with whom I have come in contact. Returning to the dock a little before midnight, the black outline of her hull seemed even more impressive as she lay with every one of her hundreds of port holes streaming with light and with the groups of electric bulbs provided for cargo working, suspended over her sides. The water had been lowered but a few inches, and the ship was barely resting upon the blocks. One or two of the shores seemed to have moved slightly and a diver was going down to see how the blocks were standing the unprecedented strain to which they were being subjected. What that weight may be one does not at present know but I fancy it must be many thousand tons in excess of the whole weight of the battleship *Dreadnought* with her guns, ammunition stores and bunkers—ready to go to sea in every detail. The keel of the *Lusitania* is not, of course, flat. There is a considerable rise in it and the keel blocks had to be varied in height to suit her contour so that each block should take its due proportion and no more. There were also bilge blocks provided to assist in bearing the weight, and thus not only had the dock to be prepared with mathematical accuracy for the reception of the giant, but immense pains had to be taken to get her in absolutely the right spot, ere the water began to be lowered. Excess of precaution raised a doubt as to whether all was well, and

as the report of the diver does not seem to have been sufficiently convincing to those in charge of the operations the ship was taken out into the basin, the water lowered in the vacant dock and the fact demonstrated that nothing had gone wrong. Then the ship was redocked by the afternoon tide. There was, as it turned out, absolutely no need for the scare or for the delay in lowering the water. But in view of the immense interests at risk and of the unprecedented magnitude of the task set before those who had to dock so enormous a vessel, it was wise to take no chances and to sacrifice a period of four-and-twenty hours to demonstrate that all was indeed well. On the Friday morning the wondrous curves of her lower hull and the well protected rudder and screws were visible to all who chose to visit the dock.

The Combine's Ships

do not appear to have the best of good fortune. Down to the time of writing the *Darien* of the Leyland line—whose stranding on the coast of Brazil at the beginning of the present year has already been noticed in this column—is still in the hands of the salvors, who report that there is still a thousand tons of cargo in the ship. The chances of floating her are still considered favourable, and further gear is being sent for with a view to a final effort. The cost of these protracted operations will in any event be considerable.

Another ship of the same fleet, which, like the *Darien*, was once under the flag of the old West India and Pacific Steam Navigation Company, is in more serious trouble. This is the Company's *Nicaraguan*, which left Norfolk, Virginia, for Dublin on the 8th June in the course of her voyage from Tampa. Uneasiness in respect of her began to be felt towards the end of June, and re-insurances were effected at seven guineas. Nothing being heard of the ship the price rapidly rose until the price of ninety guineas was reached, and she thus became practically uninsurable, and one fears that there can now be little hope of her safety.

Turbine Steamers.

The Fairfield yard has now launched the second of the fine express steamers which it has under construction for the Egyptian Mail Company. The vessel in question is named the *Cairo*, and is an exact sister to the *Heliopolis*, whose details were commented on last month. Another vessel engined on the turbine system is the *Hirafu Maru*, launched from Messrs. Denny's yard at Dumbarton on the 10th July. This vessel is notable as being the first turbine vessel of the Japanese mercantile fleet. She is of the class used for cross-channel services in this country, though she is not quite as fast as the recent additions to our own fleets of the narrow seas, her speed being but eighteen knots. Even at that rate, however, it is anticipated that she will diminish by some 50 per cent. the time absorbed on the voyage for which she is designed—the crossing of the Straits of Tsugaru. Her owners are the Japanese State Railways, whose lines on the two principal islands of the Empire she will link up.

The "Kron Prinz Wilhelm"

of the Nord Deutschser Lloyd Company, which arrived at New York on the 10th July, reported that she had "grazed a small iceberg" at midnight on the 8th of the month, but was in no way injured. The fact that the results were not serious is evidenced by the sailing of the vessel on her eastward voyage at her regular date. The incident is, therefore, in itself of but little importance, but it cannot fail to make one think. In spite of the increase in strength and size of steamships, in spite of the improvements in design and of the introduction of Stone-Lloyd bulkhead doors, the danger of contact with outside objects remains. Carelessly navigated vessels, derelicts, wreckage and ice are dangers that the highest skill and the most ceaseless vigilance cannot always avoid and the results of contact with them by fast-running steamers crowded with passengers are by no means a pleasant subject of contemplation, and the Lloyd may be congratulated on the escape of this fine vessel.

The "Niobe."

An interesting point of law has been adjudicated upon by the Rouen Court of Appeal. It arose out of the circumrtances concerning the loss of the steamship *Niobe*, which was sunk by collision with s.s. *Gregory* in Havre Roads on the 28th November, 1905. The wreck of the *Niobe* has been removed by the French authorities and their courts had meanwhile fixed the *Gregory* with the blame for the collision. Now came up the question of recovering the expenses of removal of the wreck. The port authorities were successful in causing the owners of the *Gregory* to make them good as part of the damages caused by the collision, in spite of their suggestion that if those in charge of the *Niobe* had navigated their ship otherwise than they did, the expenses might not have been incurred. The answer to that, of course, is that those who have put others into a position of grave difficulty and imminent danger are not able to avoid the consequences of these acts on the ground that if something other than was actually done, had been done after the critical moment, the amount of final loss might have been minimised. This would be English as well as French law, and so the *Gregory* has to pay.

Wireless Telegraphy.

It may be remembered that an international convention for the consideration of proposals for the regulation of wireless telegraphy was held at Berlin last year. Some dissatisfaction with its conclusions was expressed in this country, and a Select Committee was appointed to consider the matter. This Committee has now issued a report which contains a good deal of interesting information. The rapid development of the system is shown and the fact seems conclusive proof of the desirability for immediate regulation. Much money would have been saved and public convenience vastly served, if inland telegraphy in this country, and even our British system of telephones, could have been dealt with on some intelligent plan before their extension rendered them unwieldy. The chief difficulty in wireless telegraphy seems to have been due to the fact that there are more systems than one in public use, and that, whilst public convenience would obviously be served by allowing every station to use every system, the individual companies naturally wish, as far as possible, to boycott their rivals. It would appear that in Great Britain, Canada and Italy the Marconi system has secured a practical monopoly, but that in other parts of the world other systems are favoured. The Marconi Company further entered into an agreement in 1901 with Lloyd's whereby that corporation was bound to employ their system only till the year 1915. In 1901 there was much to lead Lloyd's to enter into such an arrangement. The underwriters saw the immense possibilities of radio-telegraphy, and how it might be used for communicating orders to vessels at sea, and for giving notice of wrecks and casualties, as well as for the transmission of ordinary news. The Marconi system was then practically the only one in vogue, and the action of Lloyd's in this matter seemed to show great enterprise and foresight on their part. Events have, however, proved that the tying up of a great body like Lloyd's, with its 1300 stations all engaged in what is practically the public service, to one system is not really to the public interest, and the Select Committee expresses its belief that the agreement will either have to be cancelled altogether or at least considerably modified. It further expresses its opinion that if the Post Office had secured a right of pre-emption when its officials were working in conjunction with Signor Marconi, much of the trouble which has occurred might have been avoided. But surely the Committee, in suggesting business foresight to the Post Office officials, is expecting more than can be asked of Government officials. Further, the Post Office policy of refraining when it could from issuing licences to other companies encouraged the Marconi Company in their dreams of a universal monopoly. Finally, the Committee recommend this country's adhesion to the convention on national and international grounds. Thus if its recommendation be followed we shall soon see all stations accepting messages on any system, and in consequence a great extension of the usefulness of radio-telegraphy for those connected with the shipping industry.

The Thames Steamboats.

Whether it be the unprecedently unpropitious weather which has marked the present summer or whether it be that the novelty of the vessels is wearing off, and that thus the few people who patronized the London County Council's fleet have ceased to care about using it, cannot be ascertained, but the fact remains that this season's working has been much less satisfactory than that of 1906. From 15th May, 1907 (when the boats recommenced running), till 29th June

the total of passengers was 615,589 against 892,454 for the corresponding period in the previous year. The receipts show a similar falling off, being only £5712 for 1907, against £7002 for 1906.

Southampton

seems lucky in many respects. It was believed that the cost of dredging the channel to a depth of 32 ft. at low water would amount to between £50,000 and £60,000. The committee, however, seems likely to get the work done for about £25,000. The material to be dredged is, of course, very soft and easily worked, and for that reason one might have imagined that a greater depth than this would have been the aim of the authorities. The *Lusitania's* load draught seems to be about 36 ft., and the constant tendency seems to be towards bigger and bigger ships. Southampton, with its large aspirations, might well be content to spend a little money in completing the facilities of its port.

The Canadian-Pacific Railway

has just added two interesting vessels to its fleet. These are the *Assinboia* and the *Keewatin*, sister vessels built at the Fairfield yard. The former was launched on the 25th June and the latter on the 6th July. The steamers in question are of 4300 tons gross register, and are fitted with quadruple-expansion engines. They are specially designed for service on the Great American lakes, and are accordingly fitted for the accommodation of passengers as well as for the carriage of grain cargoes. The interesting point about these ships is that, being too big for the passage of the canals which connect the great lakes with the ocean, they are, after crossing the Atlantic, to be cut in two and towed up the waterways in sections and then be reconstructed on reaching the scene of their intended activity.

The Australian Mail Contract.

No one will be surprised at the breakdown of the contract between the Australasian Commonwealth and the Harris Dixon syndicate. From the beginning it was recognised that the arrangements had not the elements of success for the contractors, and it was certain that as time went on all concerned would have that conviction borne in upon them. Then defections came and difficulties in obtaining the requisite capital. The cancellation of the contract followed almost of necessity. New tenders have already been advertised for. The Orient Royal Mail contract having been primarily extended for another year, the new contractors will be required to commence operations in the first half of February, 1909. The new contract will embody the white labour clause; provision for possible alteration in the Continental port originally fixed upon; the right to substitute another route for that *via* the Suez Canal, and an undertaking on the part of the contractor that he will not give an undue preference to any person outside the British dominions.

The Accident

to the *Kaiser Wilhelm der Zweite* is more serious in its indirect effects than in its direct effect on that fine vessel. It appears that on Saturday, the 20th July, she was being coaled at Bremerhaven and had naturally her coaling ports open. Suddenly she took a big list and a large quantity of water flowed into the vessel. The influx of course increased the list and prevented the shutting of the ports by which the water was entering. After a time the control was obtained, the water pumped out and the vessel righted. But a certain small amount of damage has been done to her internal fittings, and she was obliged to miss her sailing on the 23rd July, the passengers booked for the voyage being sent forward by other conveyance. This is the serious part of the matter, for the inconvenience to passengers and the dislocation of the company's arrangements are both considerable and annoying, whilst the fact of a great passenger liner of this character missing a voyage at the busy season of the year is a heavy financial loss to the owners. The accident, though unusual, is one by no means unprecedented in its character. I think the case which most nearly resembles it in character and effects was that of the *Germanic*, which some years ago was overborne by weight of ice at New York. The damage in that case was solely material—the whole loss sustained being occasioned by injury to fittings, and the cost of raising the vessel not being very serious. Other cases that leap to one's memory were the case of the Orient Liner *Austral*, sunk whilst coaling at Sydney some years ago and only raised after great and very costly efforts. Another similar accident was that to the same line's ss. *Orotava*, which heeled over in Tilbury Dock, this accident like that of the *Austral* being unfortunately attended by loss of life.

The *Kaiser Wilhelm der Zweite's* accident seems to have been due to the fact that she was not quite afloat at the time that the coaling operations were commenced. She was at least partly on and in the mud and this fact prevented the ship from listing gradually, as what proved to be an undue quantity of coal was put into the bunkers on one side. As the ship remained quite upright, those in charge of the coaling operations were given no indication of the fact that what they were doing was seriously affecting the stability of the ship. Then when enough weight had been put in the one side to bring the ship's coaling ports, if afloat, below the level of the water, she was suddenly released from the mud by the rising tide. Then the mischief was done and its results followed so quickly that little or nothing could be effected to avert or minimise them.

STRUCTURAL DEVELOPMENT IN BRITISH MERCHANT SHIPS.*

By J. Foster-King, Esq., Member.

It is necessary to the proper limning of any mental picture of the processes whereby the modern steel merchant ship has developed, to work upon a background formed by the wood shipbuilding methods of the last generation, which still seem to have a hampering effect upon design, and that our ideas should be influenced by the exceeding age of shipbuilding. It is of something more than academic interest to see in Sir George Holmes' interesting book on "Ships Ancient and Modern," a picture of an Egyptian ship built 7,000 years ago, having a length of 100 ft. and overhung ends supported on the principle of the truss girder, and to be told that the Egyptians appear to have built ships out of short thick pieces of hard wood so ingeniously dove-tailed and fastened together that the external shell was apparently capable of providing sufficient structural strength without the assistance of side framing. As bearing upon the possibility that modern wood building methods may not have developed on the best lines, the Viking ship of old (particulars of which are to be found in Mr. Archer's paper read before the I.N.A. in 1881), with its beautiful form and combination of lightness and strength in hull structure, should also be a feature in the background of the picture. There is no change in principle from the known constructive methods of its thousand-year-old predecessor, a principle which probably was then thousands of years old. The whole strength is contained in the external shell—the function of the frames being more constructive than structural and the hull girder has its bottom and sides formed of planks properly riveted together, in association with small top members which present no obstruction to goods or passengers, and are kept apart only by beams. The structural efficiency of the type is proved by its known capacity for overloads of plunder or shipwrecked mariners and for ocean voyages of almost incredible length. The steel ship again is the fruit of a period of growth contemporary with the life time of one man, a period sufficiently short to satisfy us that it cannot yet be the fruit of the tree of perfect knowledge, and that present day requirements should include, not only careful cultivation and improvements of tried types, but cautious experiments with new species.

As iron shipbuilding is a product of steam and the iron boilermaker, it was in a sense natural that its earlier application and development should be in connection

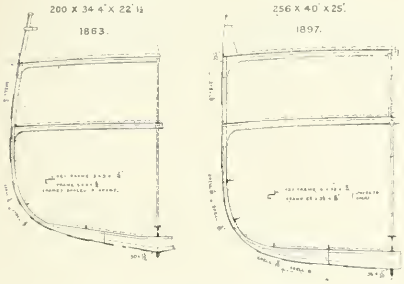
* Read at the Bordeaux International Congress and Summer Meetings of the Forty-eighth Session of the Institution of Naval Architects, June 25, 1907.

with steamships; but, inasmuch as its history has witnessed not only the practical extinction of wood as a shipbuilding material for both steam and sailing vessels of any size, but of the application of any material to the construction of the larger class of sailing vessel, it may be regarded as desirable to first refer to the iron and steel sailing ship, as it forms a chapter in the history of structural evolution which is for the moment complete.

Fig. 2 shows the type of structural design which obtained over forty years ago, when sailers where probably more common in shipyards than steamers, and when the large iron sailer of about 200 ft. length might be said to have taken up the work of the wood ship of similar dimensions, having behind it all the advantages in design derived from thirty years' experience in iron steamship construction. Fig. 3 shows the section of what was still considered a large steel sailing ship when built some ten years ago, having a length of 256 ft.,

Fig. 2. SAILING SHIP. 200 X 34 4 X 22 1½ 1863.

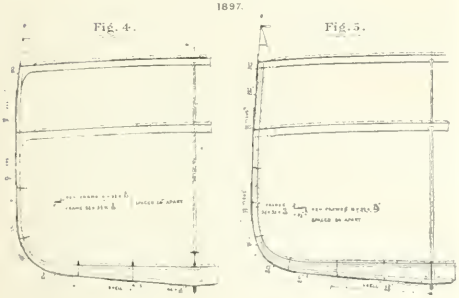
Fig. 3. SAILING SHIP. 256 X 40 X 25. 1897.



LARGE TYPE OF SAILING SHIP 280 X 42 11 X 26 0 1897.

Fig. 4.

Fig. 5.



which shows that, although dimensions and displacement co-efficients had increased by about 20 per cent., and scantlings had decreased considerably, there had been no change in principle, except that the second deck stringer and side keelson were connected to the shell. The structural arrangements embody, in different degrees, a shell of great thickness in proportion to length, supported by comparatively shallow frames in association with two complete tiers of beams and no bulkheads were fitted abaft the collision bulkhead. The whole forms a girder of simple design consisting of bottom, sides, and relatively small top members, and its persistence during so long a period ought to suggest sufficiency. I venture to describe the top members as small, because experience has confirmed me in the faith that wood should not be accepted as an efficient contributory to the strength of iron and steel structures, because the qualities of the materials are too far apart. Figs. 4 and 5 show the sailing ship of 280 ft. by 42 ft. 11 in. by 26 ft. * which may be regarded as the apex of commercial development in British sailing tonnage, if we except the few cases in which the length was increased. Fig 4 shows the ordinary method of construction under Lloyd's Rules, which is a continuance on the lines of the previous plans, plus the introduction of increased sizes of keelsons and stringers supplemented by intercostal shell attachments, together with a complete steel upper deck. Fig. 5 shows the construction of sister vessels built under the Rules of the British Corporation, where deep frames are fitted; the shell is about 10 per cent. lighter than in the corresponding vessels, there is greater complication in the internal structure, but the holds are more free from obstruction. In France and Germany much larger sailing vessels have been built than in Britain, some having lengths which approach 400 ft. Unfortunately I am not in a position to show anything of their design, but should imagine it probable that they have been built much on the same plan as steamers of their size. So far as Britain is concerned, it may be said that progress in sailing-ship

Fig. 6.

"LUSITANIA" 1907 760 X 87 6 X 60 TO SHELTER DECK. STEEL

"GREAT EASTERN" 1859 680 X 82 2 X 58 0 IRON

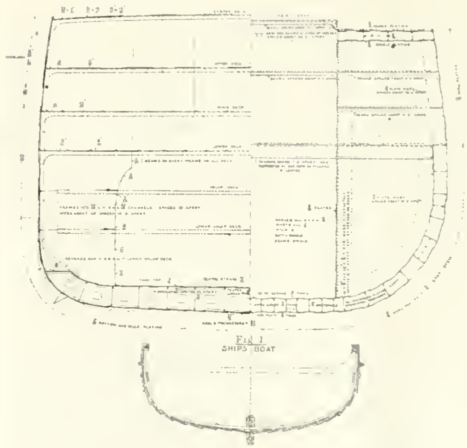


Fig. 7 SHIPS BOAT

construction has been arrested at the stage where increasing size had introduced complexity born of doubt, and if circumstances were to re-create a demand for new sailing ships, history would probably repeat itself, and then construction would commence anew on simpler methods justified by experience with steamers.

The story of the evolution of the very large mail and passenger steamer might justly be said to be epitomised in the papers on the *Great Eastern* and the two great Cunarders, the *Lusitania* and *Mauretania* which stand on the records of the Institutions; but, before passing to other types, it may be instructive to regard the sections of these vessels as placed side by side in Fig. 6 and to consider their salient features together. The *Great Eastern* built in 1859, was 680 ft. by 83 ft. by 58 f.t. is stated to have had no sheer, and no close-spaced transverse frames; the transverse members consisted of webs and bulkheads which averaged 16 ft. apart, only a few of them being extended to the outer shell. The tiers of beams below the the upper deck were but little better than rafters for flooring, the shell plating was only ¾ in. iron (for which modern practice would call $\frac{15}{16}$ steel the equivalent) stiffened by longitudinals 2 ft. 6 in.

* All dimensions are moulded dimensions.

apart on the bottom, 5 ft. on the bilges and sides, and 7 ft. 6 in. apart on the top sides; there was an inner skin of $\frac{1}{2}$-in. iron (equal to $\frac{8}{20}$ steel) extending up to the fourth deck, two longitudinal bulkheads of the same thickness which extended to the full depth of the ship stiffened by plate webs 5 ft. apart. The upper deck was in two layers of two thicknesses of $\frac{1}{2}$-in. plating in combination with longitudinals 5 ft. apart, so that longitudinally she was a single-deck ship, having relatively narrow but very strong top members connected to the lower part of the structure by four films of thin plating, two of which are not stiffened inside the squares of about 16 ft. by 7 ft. 6 in. formed by the deck stringers and webs. The ship was riveted throughout with $\frac{7}{8}$-in. rivets, all the plate seams were single riveted, and none of the butts had more than double riveting. There is no gainsaying the remarkable nature of these facts, and, after discounting the inevitable reduction in their importance by the influence of form, absence of sheer, great depth of hull, and relatively low speed at sea, there seems to be no escape from the conclusion that the lessons to be derived from this monument of successful structural design have not been applied in subsequent practice.

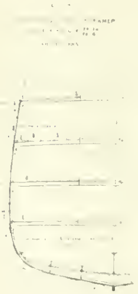
It is the custom to speak of the *Great Eastern* as being framed longitudinally, but this, of course, is not true in the literal sense of being framed longitudinally and no other way; and, as it is impossible to conceive a metal ship of any size without effective transverse members at sufficiently close intervals to permit of the stresses being transmitted thereto through longitudinal material of reasonable dimensions, it might be well to adopt some other nomenclature to show that such departures from ordinary framing systems merely indicate a widening of the distance between the transverse members.

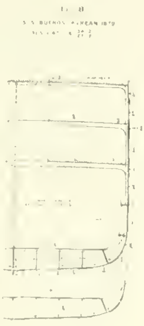
The Cunard steamers are 760 ft. by 87 ft. 6 in. by 60 ft., have sheer, the transverse frames are 32 in. apart, reinforced by web frames 10 ft. 8 in. apart; there are four complete steel decks, having beams 32 in. apart; the shell plating is $\frac{21}{20}$ to $\frac{32}{20}$; there is an inner skin $\frac{1}{2}$" thick, extending 8 ft. above the keel, stiffened by $\frac{1}{2}$" longitudinals about 6 ft. apart, in addition to the transverse floors 32 in. apart; there are two longitudinals bulkheads $\frac{18}{20}$" thick, extending up to the fourth deck, while the top member of the structure consists of two layers of thick plating connected to double topside plating over 2 in. total thickness. The riveting of the seams of shell plating is treble, and of the butts quadruple, with special double straps on the top sides.

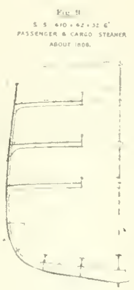
The *Lusitania* and *Mauretania* represent the latest and greatest development of a modern type, which, owing probably to the commercial failure of the older vessel, has not at any time been appreciably influenced by the example of the *Great Eastern's* structure, a type which probably shows less variation, less originality in conception, and greater excellence in execution than any other, probably because cost is not usually a paramount consideration, and it is a necessity of design that it be provided with as many decks as possible, consequently the modern tradition that the decks which are fitted under the upper deck are structural necessities has remained undisturbed in practice.

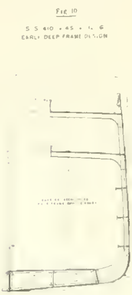
The large iron steamer for passengers and cargo even forty years ago was quite commonly of about 400 ft. in length, although some seventy years ago the largest iron steamer afloat was only 185 ft. long, and, as was to be expected, the design of the earlier iron structures was closely allied to that of contemporary wood ships. The frame spacing rarely exceeded 18 in., the bilge plating was often 25 per cent. heavier, while the sides were usually thinner than the bottom plating. Fig. 7 shows an example of the ordinary type of large passenger and cargo steamer of some thirty years ago, many of which are still running, where the weather deck had slight stringer and tie plates in association with light topside plating and a narrow sheer strake doubling, there were four tiers of beams, the second and third of which were plated, and the hold space was filled with great keelsons standing inside the framing. So far as I know, all the existing vessels of this type had the weather deck completely plated not long after construction.

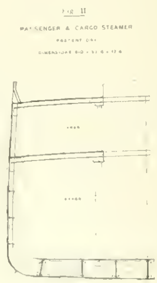
Fig. 8 shows the *Buenos Ayrean*, built by Messrs. Denny in 1879 for the Allan Line, the first steel steamer for Transatlantic service—a vessel which marks an epoch, although it only shows a structural design similar in principle to the previous case, advanced to the extent of having only three decks and web frames in the hold in association with a double bottom, and a general reduction in scantlings on account of the superior material. The double bottom construction on this section, with its excessive longitudinal material, cost, and difficulty of construction, provokes a reference to the crooked way in which such developments always seem to work; the first double bottom was simply a series of iron tanks laid on top of the ordinary floors, the next and obvious step was to rivet girders on top of the floors, plate them over, and fit watertight chocks round the frames the Macintyre tank then came the common adoption of the various designs, such as that on the *Buenos Ayrean*, where the double bottom was made part of the structural design; and by the time this stage had been reached everyone seemed to have forgotten that in the sizes of ships commonly built a double bottom provides greater bottom strength than is needed for the structure as a whole, or than is provided with the ordinary floor construction.

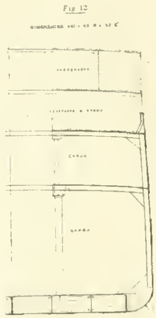










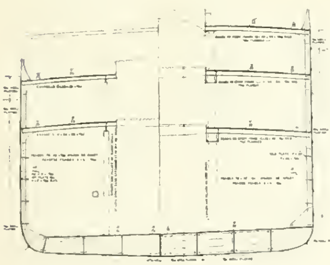


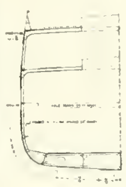
It cannot be said that the introduction of steel revolutionized shipbuilding, although it pushed progress faster, nor that the manufacturer has been ahead of the consumer, although there have been great developments since the days of the *Buenos Ayrean* in the number of sections and sizes of material available. In fact, it was not until the Standards Committee took up the work two years ago that any attempt was made in Britain to systematize the form of steel sections, or to obtain reasonable proportions of web, flange, etc., to depth of section. It is to be hoped that standardization will not spell delay in further improvement in section design and development of sizes.

Fig. 9 shows a healthier type of design of structure, which was contemporary with those just considered, where the proportions of depth of ship to breadth are improved and

the weather deck has become the strong deck., although three tiers of beams and numerous internal obstructions in the holds are still considered necessary. Without elaborating upon the intermediate stages, Fig. 10 shows the advanced design of some fifteen years ago, where the third tier of beams has been displaced, the frames increased in depth, and ornamented with H girders, while the additional beam support due to increased breadth was provided in the form of a complete centre row and two rows of quarter stanchions on alternate beams, in association with a uniform size of beam. Fig. 11 shows the practical recognition of the inutility of heavy side stringers, which, after minor intermediate phases, became universal within the last few years, as well as the deck girders in association with wide-spaced quarter pillars, which by the same time had advanced into common practice. Fig. 12 shows the very recent and what may be the final stage in the evolution of side stringers, their total disappearance from the three midship compartments; in lieu thereof the deep frames are increased in depth and width of flange, the bracket floors and beam knees increased in size beyond the normal, the frame riveting closed up, and the shell plating increased in thickness. There is no rise of floor in this particular design, so that the double bottom is lowered without reducing the capacity or depth at margin plate, and in the midship portion of the hull the double effect is obtained of reducing cost of manipulation through the reduction in number of parts as well as the fact of all the frameworks, with the exception of the small bar at the turn of bilge, being handled cold; and of providing increases in the general longitudinal and transverse strength and stiffness on no more weight of material, through the translation of the weight of the side stringers into direct increases in the shell and frames. At the ends of the vessels, where the frames are bevelled, the ordinary method of construction in association with side stringers is adopted; but development in the direction of simplicity is probable in this neighbourhood also. In this case the deck support is obtained by two girders in association with tubes about 32 ft. apart, and a simple but modern improvement in the attachment of the bracket floors to the margin plate is indicated. The type of design shown in Fig. 11 has gone on gradually from size to size, until it has reached dimensions so great as 490 ft. by 57 ft. 6 in. by 35 ft. 3 in., nor does there appear to be any reason against further extension, although it seems but yesterday that the possibility of having less than four decks in a ship of this depth would scarcely have been considered.

Fig. 13 Fig. 14 Fig. 15





It would be wrong to leave this branch of design without something more than a passing reference to the effect thereon of the individuality of the firm of Mr. Alfred Holt, of Liverpool. Mr. Wortley, of that firm, read a paper on the subject of their special design of steamer before this Institution in 1900, and by the courtesy of that gentleman I am now enabled to show on Figs. 13 and 14 the first, compared with the latest of the type built during the past year. It will be seen that the erections on the earlier design have been replaced in the latter by a complete shelter deck the weather deck being made the strength deck; the dimensions of the vessels have increased considerably, but the shell plating remains $\frac{15}{20}$ in association with 3 ft. frame spacing. The double bottom now runs straight out to the side, so that the upper frames amidships do not require to be furnaced, the typical arrangement of deck girders and wide-spaced stanchions is retained, and the deep tanks are still successfully constructed without central divisions. Mr. Wortley has been kind enough to permit the publication of the principal scantlings of these ships, so that it is an easy matter to appreciate a successful development on broader lines than ordinary: but it is not so easy to judge of the great benefit to shipowning and building which has resulted from the initiative of Mr. Wortley and his firm, nor can I too liberally acknowledge its educative effect upon myself.

The cargo steamer seems to me to be the most important species of the genus ship, not only because it is numerically the largest, but because it shows the greatest number of variations, and the greatest activity in developing these into distinct species. The ordinary large cargo steamer of thirty years ago, as exemplified in Fig. 15, was but a modification in dimensions of the contemporary passenger and cargo type just considered, ranging in length from 260 ft. to 280 ft., having two tiers of beams, a tier of wide-spaced hold beams, and, quite commonly, a double bottom.

Fig. 16 Fig. 18

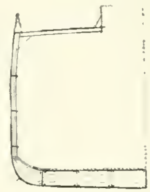
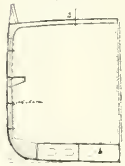
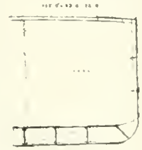


Fig. 17 Fig. 19

AMERICAN LAKE STEAMER PRESENT DAY BRITISH DESIGN





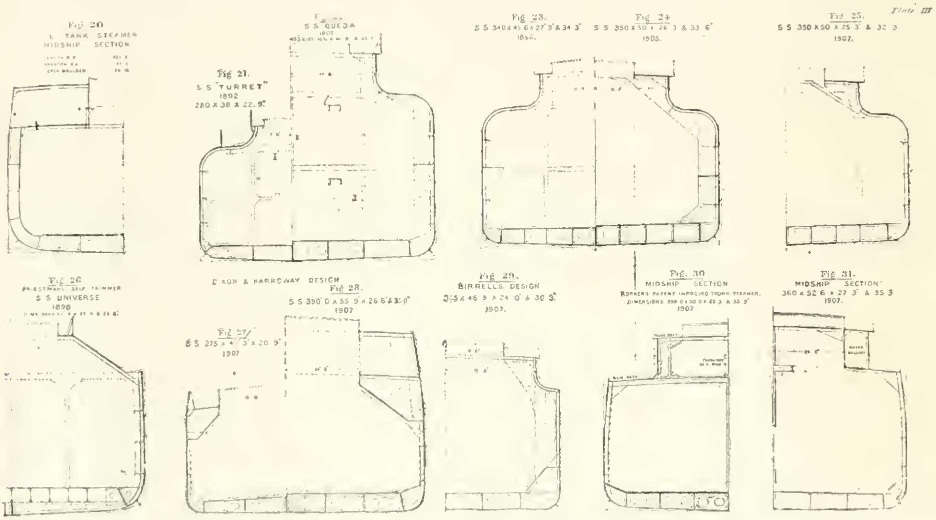
For smaller vessels the raised quarter-deck or well-deck type, was practically supreme; but it seems unnecessary to deal with them separately, as they presented few special features in construction which have not since been embodied in the now paramount type having continuous decks. The raised quarter-deck has been of evolutionary value from the fact that the demand for the omission of complete tiers of beams in way of the quarter-deck had to be faced and met almost from the beginning; so that the introduction of web frames, as an efficient substitute for a third tier of beams in a three-deck, or a second tier in a two deck ship is now a matter of quite ancient history. The web-frame ship was an improvement in design for bulk carriers, but the broken stowage for other trades created a demand which led to the deep-frame system being introduced, I believe by Messrs. Stephen, of Linthouse, about 1887; that is each frame was made stiff enough and strong enough for the longer spans caused by the omission of tiers of beams These systems have been grafted upon one which gradually increased the sizes of ordinary frames in rough porportion to the midship dimensions of the ship, and introduced additional tiers of beams at arbitrary depths, so that anomalies are not unknown in practice. The development of the deep frame and side stringer has already been illustrated so that we may jump to the developments in general design of the past fifteen years, and refer to Fig. 16, which shows the beginning of wider spacing of stanchions, and how the exigencies of bulk carrying trades led to the omission of the

wood deck from the second deck level, an omission of valueless material which seems to have been at first generally, although not universally, regarded as one having such structural importance as demanded either compensation or freeboard penalty. That a wood second deck, cut by bulkheads and non-existent in the machinery space, could ever have been regarded as an effective element in the structure of a steel ship is one of those mysteries which appear to attend all evolutions.

The S.S. *Lincluden*, 312 ft. by 42 ft. 4 in. by 26 ft. 3 in., Fig. 17, so far as I know the first real single-deck ship of this depth or near it, was built by Messrs. Furness, Withy & Co., of West Hartlepool, in 1896, and was considered to be a radical, if not dangerous, departure; but circumstances have more than justified the design, and this ship was the forerunner of a type which is now becoming comparatively common. A number of relatively large vessels have been built having wide-spaced strong beams in association with wide stringer plates at mid depth, but the largest vessels of ordinary form of which I know anything, in which reliance is placed solely upon deep framing, unsupported by beams of any kind below the upper deck, have depths of 28 ft. 6 in. to 29 ft. 6 in. (see Fig. 18.). The range of development in this type is shown by comparison of Fig. 18 with Fig. 19, a single-

secure such great transverse and longitudinal strength from material disposed of in the best position as to give the power of practically indefinite expansion in ship dimensions.

Then the "Doxford" turret shows features which make it perhaps the most interesting of these modern designs. The S.S. *Turret*, 280 ft. by 38 ft. by 22 ft. 9 in., and 27 ft. 3 in. to turret deck (Fig. 21), built in 1893, and the first vessel of the type, presents the essential features which are now familiar; the turret is an integral part of the hull, and the turret deck stringer forms the top member of the girder, the turret base is rounded to permit free flow for bulk cargo, and the junction of the harbour deck with the side is rounded to avoid waste space or trimming charges. The principle of the transverse structure in the *Turret*, the outstanding feature of which is the open framework of strong stanchions and hold beams at comparatively wide intervals, remained unchanged until recently, the larger number of turret vessels built up to that time being, as shown on Fig. 22, vessels, 340 ft. by 45ft. 6 in. by 27 ft. 3 in., and 34 ft. 3 in. to the turret deck, having modified webs in association with the built beams and stanchions. The largest development on these lines is to be found in (Fig. 23) three steamers for the B. I. Company, 455 ft. by 58 ft. by 33 ft., and 41ft. 9 in. to the turret deck. Longitudinally, these vessels are pure single-deck ships in



deck steamer, 252 ft. by 43 ft. 6 in. by 23 ft. 6 in., of which a number have been built for service on the American Lakes, and whose depth corresponds with the least for which three tiers of beams used to be the standard. We have already reached a close approximation in design to an open boat with a portable deck, and if trade requirements demand it we are yet far from having reached any limitation upon the dimensions of this type based on practical considerations. The evolution of the single-deck steamer from the three-deck type has been on clear, well defined lines, but recent activity in designing new methods of construction and types of ship intended to solve the problem of combining large capacity and large dead weight on limited draught with ample water ballast capacity, unbroken stowage, absence of hand trimming for bulk cargoes, and simplicity of construction has produced designs which are such variations from the the parent ship as to form distinct species, and which have already had in some cases quite an evolutionary history. For example, Fig. 20 shows Mr. McGlashan's ship, in which there is no change in external form, but where, by the simple expedient of adopting two skins of plating, it is possible, not only to carry a very large quantity of water ballast, having a higher centre of gravity than the normal, but to

so far that all the material is contained on the outside walls, while the turret design of transverse framework is adhered to, plus the addition of large webs between the hold beams. These vessels each carry over 2000 tons of water in a deep midship tank 36 ft. long, of which the turret deck is the crown, and the base of which is subject to a pressure of considerably over a ton per square foot, while the central wash division stops at the level of the broadside stringer. About two years ago a novel principle in construction was introduced by Messrs. Doxford, as shown in Fig. 24 where the ship is kept in shape by wide web frames at the hatchway ends arranged continuously round the skin of the ship, of such form and strength and having such strong attachments to the double bottom (which is increased in depth) that the complete framework should be incapable of deflection in any direction, and permits of stanchions and beams below the turret deck being entirely omitted. At the present time Messrs. Doxford are building to the design shown in Fig. 25, where, by fitting large tube stanchions at the hatchway ends under the stiff turret sides, in association with diagonal ties in pairs, an interesting combination of material has been evolved.

Fig. 26 shows the Priestman self trimmer *Universe*, in

which the top sides are sloped from the upper or turret deck level to a narrow platform at the harbour deck, and the internal structure is of the wide spaced open framework type. It is of interest to note the double-bottom construction and absence of intercostals to the bottom shell.

Messrs. Sir Raylton Dixon have built a number of vessels which are known as "Harroway & Dixon's Patent," in which there are sloping ballast tanks in the corners of the top sides, as shown in Fig. 27, and where the stiffness and strength of top sides obtained by this form of construction, permit of very wide hatchways. As the vessels are so designed that it is practically impossible to conceive of deflection in the corner tanks between the bulkheads, the hatchways can be made practically the whole length of each hold, and the builders are enabled to dispense with stanchions and beams in the holds. The largest vessel yet built on this plan is 390 ft. by 55 ft. 9 in. by 26 ft. 6 in. and 35 ft. (see Fig. 28), where a shelter deck is fitted above the upper deck, and with this, as with the original single-deck design, practically unlimited expansion in dimensions of ships should be possible.

Fig. 29 shows a steamer 305 ft. by 46 ft. 9 in. by 24 ft., being built by the Sunderland Shipbuilding Company, the design of Mr. Henry Burrell, which embodies several interesting features; the double bottom is sloped up the sides of the vessel so as to form a self-trimming trough for coal or grain, and the upper works are arranged so as to give free flow for bulk cargo; while the sides, trunk way, and decks are so supported by what, for want of a better name, may be called cantilever webs, and by comparatively closely spaced bulkheads, that stanchions are unnecessary. The construction is simplified in this case by adopting a spacing of 32 in. for the frames.

Fig. 30 shows the "Ropner" trunk, in which the ship is of ordinary deep-frame construction up to the harbour deck, which is kept apart by strong beams at hatchway ends, etc., while the trunk is supported by webs, cross plating and strong-built centre stanchions in association therewith. In the earlier vessels of the type built stanchions were fitted under the trunk sides at comparatively close intervals, and the trunk was comparatively light erection experience; has shown the former to be unnecessary, and the desirability of re-arranging the material so as to make the trunk the effective top member of the girder. A remarkable development of this design is shown in Fig. 31, where the trunk sides are doubled, and spaces thus formed carry water ballast; the upper structure is supported by large webs, the engines are placed aft, there are two hatchways, each over 100 ft. in length, and the hold is in one length from collision bulkhead to machinery space. It must be admitted that the design is abnormal, and may be taken as to some extent experimental; but its conception is indicative of the freedom which has come over the spirit of shipbuilders during recent years.

It attacked solely from the point of view of economy and efficiency of design and as a problem in engineering, unhampered by preconceived ideas of construction and trade requirements, it seems to be obvious that the natural design of a ship-shaped girder would be one which would have the material disposed entirely on the circumscribing walls, but misconceptions of true principles in design are unavoidable legacies from previous constructive methods. The influences which have caused persistence in bad disposition of longitudinal material are not easily understood; perhaps they follow from the influence of wood shipbuilding methods, while the retention of the name "Main," as applied to a deck which was not the top deck may have had the effect due to suggestion. We have certainly grown up amid the conception that numerous tiers of beams are natural and that their omission demands compensation, instead of what seems to be the sound idea, exemplified by Messrs. Brunel and Scott Russell half a century ago, that the ideal structure would have the longitudinal material massed on the upper deck, bottom and sides; the transverse members would be of the simplest form and fewest number possible, with their contributory elements as far apart as the thickness of plating would permit; while additional tiers of beams or layers of plating would be regarded as unscientific and to be fitted only under compulsion of trade conditions, but that, when fitted, the best use had to be made of them as factors in the structural equation, in order to minimise what must necessarily be wasteful in weight, just as is the central core of a shaft or any other massing of material in the wrong place.

It appears to me that a study of the diagrams will show that the tendency of all types of development, with the exception of the large mail and passenger steamer, has been towards reduction in number of parts, economy of labour, rather than of weight, to a probably unconscious realization of the principles of design which I have ventured to put forward as the best; and particularly in the case of bulk carriers to the closest possible approximation to an open boat—a design which seems to be not only the child of the ages, but the father of the ideal design for such vessels.

SOME PRACTICAL POINTS IN THE APPLICATION OF THE MARINE STEAM TURBINE.

By the Hon. C. A. Parsons, C.B., F.R.S. (Member of Council), and H. Wheatley Ridsdale, Esq. (Member).

Earlier papers on steam turbines have dealt primarily with this type of engine and its several applications, including among them the propulsion of ships; we therefore propose, in this paper, to discuss some important questions of special interest in the design, construction, and running of steam turbine installations, and venture to think that some further information and facts may be not without interest to the members of this Institution.

There are already in service, at the time of writing this paper, sixty-one steamers fitted with Parsons turbines, and sixty-five under construction representing a total horse-power for merchant vessels and yachts of about 500,000 I.H.P., and for war vessels about 800,000 I.H.P. Some of the vessels first fitted have been running now for some years; for instance, the *King Edward*, with six and a half seasons, the *Queen Alexandra*, with five and a half seasons, and *The Queen*, with four years, while others have only recently been put into service. The greater part of the running has been done in passenger service in waters frequented by a large amount of traffic, and with very frequent and difficult arrivals at and departures from harbours and piers. In view of the fact that the whole of this service has been conducted with unusual regularity and without a serious mishap of any description, and that the ships are fitted with an entirely new type of machinery, the inference seems to be conclusive as regards the safety with which turbine-propelled vessels can be handled, and we propose now to examine the facts in regard to the manœuvring qualities of turbine vessels, merely remarking in passing that the majority of these ships have been handled by men coming direct from paddle or ordinary screw vessels, without any period of apprenticeship to turbine boats.

In the actual handling of a steamer in crowded waters, in narrow channels, in entering harbours, and in approaching piers and landing-stages, or in docking and undocking, the reliability of her reversing arrangements—the perfect and prompt obedience of the machinery—is the primary consideration. It has been stated by a well-known shipowner in a discussion on a paper a few years ago† that "more cases of accidents come up at Lloyd's Classification Committee through striking dock walls and pier-heads than from any other cause." Such accidents must be principally due to the engines themselves failing to respond quickly to the orders from the bridge. The relative absence of accidents from such causes with turbine steamers goes to prove that the certainty in handling is far greater than in the case of reciprocating engines, and if the man in charge knows that his ship can be brought up with absolute certainty within a distance ascertained by experience, he quickly acquires great confidence in handling her, whatever that distance may be.

The figures of actual results given below are sufficient to show that turbine ships are stopped from the moderate speeds ahead generally used in handling in practically the same, if not in less, time or distance than ordinary twin-screw vessels of the same class, and from higher speeds in not very much greater time or distance.

* Read at the Bordeaux International Congress and Summer Meetings of the Forty-eighth Session of the Institution of Naval Architects, June 25, 1907.

† Trans. I.N.A., vol. xlv., page 304.

RESULTS OF STOPPING TRIALS FROM COMPARATIVELY LOW SPEEDS

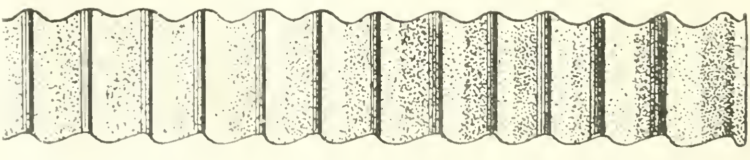
Ship and Type.	Speed ahead before reversing Knots.	Distance run before stopping. Feet	Distance run before stopping. Lengths	Time elapsed before stopping. M.	Time elapsed before stopping. S.
Turbine S.S. *Queen Alexandra*, river steamer	10	210	0.78	0	47
„ *Dieppe*, Channel steamer	12	300	1.1	0	41
„ *Princesse Elisabeth*, Channel steamer	17	516	1.5	1	5
„ *Lübeck*,* small cruiser	5	165	0.48	—	
„ „ „	9	360	1.05	—	
„ „ „	11	635	1.87	—	
„ Destroyer, 400 tons..	7	157	0.75	0	27
„ „ „	9	144	0.72	0	23
„ „ „	12	340	1.7	0	29
„ „ „	17	560	2.8	0	33
Reciprocating S.S. *Indiana* battle ship	14.5	1080	3.0	—	
„ *Hamburg*,* small cruiser	5	184	0.54	—	
„ „ „	9	360	1.05	—	
„ „ „	11	590	1.75	—	

It may be questioned whether the necessity of bringing a ship to rest from a high speed in the shortest possible distance on a straight course is of common occurrence in actual sea-going experience. In all cases where we have been able to trace reliable data, the half diameter of the turning circle, or the distance run in the direction of the original course before the ship's head is turned through eight points of the compass, is less than the distance required to bring a ship to rest from a high speed, even with the engines continuing to drive ahead; and if they are slowed or stopped, the circle is of less diameter.

(*To be Continued.*)

CAMERON'S CORRUGATED PISTON SPRINGS.

We have pleasure in giving on this page an illustration showing the design of Cameron's Corrugated Piston Springs, which have been put upon the market by Harrison & Co., steamship outfitters, etc., Sunderland. These springs are so well known and so generally appreciated that it is not necessary in this brief notice to particularize their merits; but, for the benefit of the uninitiated, we may state that when in use they are placed within the piston ring, to which they impart the requisite elasticity. Messrs. Harrison hold large stocks of the various sizes, and are consequently in a position to fulfil orders with the utmost promptitude. The firm give quotations for all descriptions of piston rings and springs, and are doing a large business in this special line, which has been immensely developed since their removal from Bridge Street to their present extensive premises in High Street. They also carry Mollerup's Genuine Noiseless Ratchet Wheel Lubricators, which are having a very large sale amongst marine engine builders, shipowners, and collieries at home and abroad.



* These figures are given on the authority of the *Marine Engineer* [illegible] December, [illegible]

NEW ZEALAND GOVERNMENT CERTIFICATES OF COMPETENCY.

THERE is one regulation in force in New Zealand which appears to act well in the interests of employers and the general public alike, besides adding a safeguard to life and property in the interests of the colony itself. The regulation in question is to the effect that Government certificates of competency are granted to those who are qualified to take charge of hand machinery and boilers. These certificates are graded first, second and third-class, according to experience and qualification, and are granted on the passing of examination. An employer has thus an opportunity of gauging the fitness of an applicant for the position of chargeman over valuable machinery and boilers, apart from his own statements and references. The subject of certificates for those in charge of machinery in the United Kingdom was discussed and a Bill was introduced to deal with such by legislation in 1807, but it was thrown out, although considered by many practical men to be good in principle and as affording an opportunity to employers of selecting competent certificated men with experience and knowledge qualified to take charge of boilers and machinery, more or less complicated.

The New Zealand Government also adopted some years ago an additional or third-grade certificate for marine engineers. This also appears to work well in practice, as it gives an impetus to the apprentice engineer to study both theory and practice while undergoing training. There is also the incentive before him of a definite object that of passing the examination when his term of training is completed and obtaining a certificate. The tendency of this would seem to be to the advantage of the ship owner, in that it should improve the junior engineers and better fit them for their work. The subject was discussed in this country in 1894 and commended as a measure which would accomplish a very desirable end; however, objections were raised to it, and although considered by the engineering societies—whose members discussed the question on invitation—as worthy of adoption, the third-grade certificate was omitted from the Board of Trade regulations.

THE SCREW PROPELLER.

XIII.*

By A. E. SEATON, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

AFTER some years of experience with the screw driven direct by horizontal engines, instead of by various kinds of engines geared to the screw shaft, engineers began to consider that the diameter of the screw should bear some relation to the stroke of the engine, instead of being regulated solely by the draught of water of the ship. Now, although *prima facie* there seemed no more logic in the one method than in the other, on looking closer into the facts this new factor would withstand adverse criticism better than did the old. The length of stroke was then largely governed by the beam of the ship, and the beam was no bad criterion of the displacement of the ships as then built: it must be also remembered that the speed of the smaller ships was seldom then over ten knots, and that of the larger 12 knots. It was also true that the diameter of the cylinders varied roughly with the stroke, consequently the diameter of screw might then with reason be influenced by the length of stroke of the engine.

As a matter of fact the indicated horse power varies as the square of the diameter of the cylinder multiplied by the length of stroke. If the diameter bears a constant relation to the stroke, then I.H.P. varies as stroke ^{3}.

It will be seen later on that the I.H.P. varies as the cube of the diameter of the screw, or rather that the diameter of the screw varies as the cube root of the indicated horse power per revolution—

That is, in similar ships, diameter of screw

$$= f \sqrt[3]{\frac{I\ H\ P}{R}}$$

It follows then that since I.H.P. varies as diameter cubed, and I.H.P. varies as stroke cubed, that diameter of screw varies as the stroke of engine.

In H.M. service, when the horizontal direct-acting engine was the almost universal practice—say, from 1860 to 1870—the diameter of screw in battleships and full-powered frigates was on the average 5·3 times the length of stroke of the engines, and varied from 4·75 to 6 times. With the corvette and sloop class the average was the same, while in the smaller ships and gunboats it was 5·57 times the stroke.

During the same period in the mercantile marine the ratio of diameter of screw to the stroke of the vertical engines then in general use was on the average 4·55, and varied from 4·2 in the very large ships to 5·0 in the smaller ones, where there was still a hankering after the largest screw that the draught of water permitted, while in the largest ships that same limitation kept the screw somewhat smaller than it would have been otherwise.

To-day we find that in H.M. Navy the battleships and first-class cruisers have screws the diameter of which is generally 4 times that of the piston stroke with three-crank engines and 4·4 times with four-crank engines. Second-class cruisers with three-crank engines have, as a rule, screws of a diameter 4·2 times the piston stroke and those with four-crank engines 4·83; with the small craft, such as torpedo-gunboats, destroyers, etc., the ratio is only 4·43.

In the mercantile marine to-day the largest ships are not so limited to draught of water as formerly, for Atlantic liners now load to 30 feet and even more. Moreover, nearly all the very large ships are twin-screw, so that the engine builder or naval architect has practically a free hand so far as diameter of screw is concerned. In the older single-screw ships, from 1870 to 1890, the length of stroke varied from 4·5 to 5·5 feet, and in the *Umbria*, the last of these large single-screw ships, the piston stroke is 6 feet, and their propellers are in diameter about 4·33 the stroke of their engines. Since 1888, when the *City of Paris* and the *City of New York* were launched, transatlantic passenger steamers of highest speed have been all twin-screws, and the stroke of their engines is now, in such ships as the *Oceanic* and *Deutschland*, 6 feet, and 5 feet 9 in. in the *Lucania*, and shorter with the other less powerful boats. Their screws are in diameter from 3·5 to 4 times the stroke, and on the average may be taken at 3·8 times.

Single-screw ships, such as form a large part of the fleet of passenger steamers running regularly to India and the Eastern world, to the Cape and Australia, whose trial speeds are from 15 to 20 knots, have screws with a diameter 3·5 times the stroke; in similar ships, but with a speed of 12 to 15 knots, the ratio is 3·82, and in smaller ships it is about 4·0. In tramp steamers, that is those whose prismatic co-efficient of displacement is over 0·75, the diameter of screw must necessarily be large, and in their case the ratio is generally from 4·3 in big ships to 4·66 in the smaller ones.

But after all, seeing how arbitrary is the decision as to length of stroke, no rule based solely on it is of any use except that in a general way it prevents crudities in diameter when the engines are of normal proportions. If, however, diameter and stroke be taken together into account, a simple rule may be used which will give results almost as satisfactory as deduced by much more recondite methods.

To find the diameter of a screw propeller in feet, D and S being the diameter of the low pressure cylinder and stroke of piston both in feet, then:

Rule I. Diameter of Propeller $= F \times \sqrt[3]{D^2 \times S}$

For fine-lined screw-ships F may be taken about 3·0; for full-lined tramps it may be as high as 3·25. For twin-screws *a reduction of 8 per cent.* may be made, so in their case F is 2·76 for fine lines to 3·0.

Another method for obtaining the diameter of a screw propeller, with a degree of exactness beyond that of the above, is as follows: R stands for the number of revolutions per minute, P is the prismatic co-efficient of displacement, and N a multiplier, which for single screws is 7·25; for twin screws 6·55; and for triple screws 6·0 for the centre and 5·55 for the wings.

Rule II. Diameter of Screw $= N \times P \sqrt[3]{\frac{I\ H\ P}{R}}$

The sizes given by this rule are such as to suit the every day sea going requirements of a steamship giving the best results in fine weather and good results in bad weather. As the best results are obtained with such screws in a smooth sea, and little or no

* For Articles I. to XII see last twelve issues

wind, and suitable therefore for ships whose work is mostly done in estuaries and rivers, somewhat larger screws will do better if the draught of water permits for full speed, or against a headwind in a seaway. The value of F may, therefore, for ocean ships, be 5% larger if they are intended to steam full power always. As examples of how these rules work out in practice, the following may be taken:—

(*a*) A single screw passenger steamer of 8,500 tons displacement has engines indicating 6,400 H.P. at 66 revolutions. Her prismatic co-efficient is 0·63. Engines with low-pressure cylinder 96 ins. diameter and 5·5 feet stroke.

(Rule I.) Diameter of Screw $= 3 \times \sqrt{8^2 \times 5{\cdot}5} = 21{\cdot}0$ ft.

(Rule II.) Diameter of Screw

$$= 7{\cdot}25 \times {\cdot}63 \sqrt[3]{\frac{6400}{66}} = 20{\cdot}3 \text{ ft.}$$

Adding 5% for ocean work, diameter = 21·3 ft.

(*b*) A twin screw steamer of 3,000 tons has engines indicating 9,000 H.P. at 150 revolutions, the low-pressure cylinders being equal to 68 ins. diameter and 36 ins. stroke; the prismatic co-efficient is 0·55.

(Rule I.) Diameter of Screw $= 2{\cdot}76 \times \sqrt{5{\cdot}67^2 \times 3{\cdot}0} =$ 12·6 ft.

(Rule II.) Diameter of Screw $= 6{\cdot}55 \times 0{\cdot}60 \sqrt[3]{\frac{4500}{150}} =$ 12·18 ft.

If required for ocean work add 5% when diameter is 12·79 ft.

(*c*) A tramp steamer of 10,000 tons displacement, having engines with low-pressure cylinder 72 ins. diameter and 48 ins. stroke; and indicates 2,100 H.P. at 70 revolutions; her prismatic co-efficient is 0·78.

(Rule I.) Diameter of Screw

$$= 3{\cdot}25 \times \sqrt{6^2 \times 4} = 17{\cdot}03 \text{ ft.}$$

(Rule II.) Diameter of Screw

$$= 7{\cdot}25 \times 0{\cdot}78 \sqrt[3]{\frac{2100}{70}} = 17{\cdot}5 \text{ ft.}$$

(*d*) A turbine steamer of 1,000 tons has three screws; the power developed is equal to 3,600 I.H.P. at 500 revolutions, the prismatic co-efficient is 0·60.

Diameter of Wing Propellers

$$= 5{\cdot}55 \times 0{\cdot}6 \times \sqrt[3]{\frac{1200}{500}} = 4{\cdot}46 \text{ ft.}$$

Diameter of Centre Screw

$$= 6{\cdot}0 \times 0{\cdot}6 \times \sqrt[3]{\frac{1200}{500}} = 4{\cdot}82 \text{ ft.}$$

(*e*) A turbine steamer of 15,000 tons displacement has three screws, taking a power equal to 12,000 I.H.P. to drive them at 300 revolutions; the prismatic co-efficient is 0·66.

Diameter of Wing Propellers

$$= 5{\cdot}55 \times 0{\cdot}66 \times \sqrt[3]{\frac{4000}{3}} = 8{\cdot}68 \text{ ft.}$$

Diameter of Centre Screw

$$= 6{\cdot}0 \times 0{\cdot}66 \times \sqrt[3]{\frac{4000}{3}} = 9{\cdot}39 \text{ ft.}$$

A memorial is to be presented to the Postmaster General with a view to reduction in the postage of the transactions of societies. The British Science Guild has now the matter in hand and those who are interested in the subject are desired to communicate with the secretary, Sir Alex. Pedler, 28, Stanhope Gardens, Queen's Gate, S.W.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

The Relative Strength of the Fleets.

WHAT is usually described as the Dilke Return was issued this year with nominal lists of ships, and no distinction between those of the latest type and those of earlier construction than was to be found in the figures giving particulars of age, etc. However, in order to present an accurate account of the various fleets in their relation to one another, a further return was issued at the instance of Lord Cawdor, showing the comparative strength in completed first-class battleships less than twenty-five years old, and armoured cruisers less than twenty years old of the five principal naval Powers; those ships considered to be obsolescent in type being distinguished from later vessels. The following tables will show the state of the navies in effective ships, and ships building in these two classes.

BATTLESHIPS.
Less than 25 years old on June 1, 1907.

Nation.	Total.	Obsolescent.	Later Types.
Great Britain	57	18	39
United States	22	4	18
France..............	20	7	13
Germany...........	20	9	11
Japan	11	2	9

ARMOURED CRUISERS.
Less than 20 years old on June 1, 1907.

Great Britain, 32; United States, 12; France, 18; Germany, 6; Japan, 10.

Among the French battleships in the second column the *Iena*, which was badly damaged by explosion and fire recently, is included.

BATTLESHIPS.
Under construction and projected.

Nation.	Total.	Older Types.	Dreadnought Types.
Great Britain	7	2	5
United States	7	5	2
France..............	10	4	6
Germany...........	8	4	4
Japan	2	—	2

ARMOURED CRUISERS.
Under construction and projected.

Nation.	Total.	Under 17,250 tons.	17,250 tons and over.
Great Britain	6	3	3
United States	3	3	—
France..............	4	4	—
Germany...........	4	3	1
Japan	3	1	2

Portsmouth Dockyard.

The exigencies of preparing a paper for press being considered it will be understood that I am writing this before the *Bellerophon* is launched, and therefore am unable to give you any details of the function that is to take place on Saturday, July 27th Princess Henry of Battenberg having promised to perform the ceremony. The launch should be an imposing one, for the vessel will be the largest warship ever put into the water at this or any other yard. She is to be considerably larger than the *Dreadnought*, and will embody many additional special features. All the experience obtained at the trials of the name-ship is being introduced in the construction of the new ship, whose launching weight

will be about 7,000 tons, not bad work, seeing that she was only laid down on December 3rd, 1906. An Admiralty order has recently been received limiting the expenses in connection with the launching of warships to £40 for ordinary purposes and £120 in the event of Royalty attending. It is felt here that the occasion of the launching of a battleship like the *Dreadnought* or *Bellerophon* is one that is entitled to some display, but to restrict the expenditure to such a small amount means that no display whatever can take place. For £120 will not go very far for the entertainment of Royalty. Still, as the order of the day is economy, the officials must endeavour to get everything in for that amount, including the luncheon, but it will require some care and cutting down to do so. I wonder what a private firm would spend on the launch of such a vessel, but then in their case it is good advertisement. Economy is being carried out in other directions, but I can find no sound reason to assume that refits and repairs are not being carried out as they should be. For instance, there has been some talk about the cruiser *Crescent*, which recently came home from a commission on the Cape station, because instead of being thoroughly overhauled she was re-commissioned and sent to Singapore with relief crews; but the fact is that she required very few repairs, and these are being made much quicker now than formerly. On July 19th and 20th the Lords of the Admiralty made their annual inspection of the yard and naval establishments, but these visits have not the importance they once had, as individual members of the Board are frequently here attending to details relating to their own departments.

Chatham Dockyard.

Although the number of ships in the basins is gradually decreasing there is no particular slackness of work, and as several vessels have to come later on for refits there should be no lack of employment for some time. The work of making good the defects and effecting repairs on board the battleship *Triumph* have been completed, and she should have left by the time this is published to rejoin the Channel Fleet. Her sister ship, the *Swiftsure*, is to come here for a refit at the end of the summer. The *Black Prince* has rejoined the flag of Rear-Admiral Adair, commanding the Second Cruiser Squadron, having previously acted as escort to the King on his journey to and from Ireland. The cruiser *Natal* had some trouble with her machinery, which necessitated her return here. Various rumours have been circulated as to serious defects having been discovered in her gun mountings. It appears that when the 7·5 inch guns were fired the cylinders became scored in consequence of the lack of effective lubrication, and in order to make the necessary repairs the guns had to be dismounted. She was thus prevented from taking part in the cruise of the Fifth Cruiser Squadron. The *Roxburgh*, of the the First Cruiser Squadron, has completed her maiden commission and is now in port to be paid off and re-commissioned. The Juno, which has been undergoing a refit, has also been re-commissioned for further service with the Channel Fleet. She will not be seen here again, as she is now attached to Portsmouth. Good progress is being made with the work of converting the cruiser *Blenheim* into a depot ship for destroyers. The *Blake*, which arrived from Devonport on July 1st, is to be similarly converted. To adapt the *Blake* for her new duties her main armament—two 9·2 inch and ten 6 inch guns—will be surrendered, all sponsors and casemates will be removed in order to give greater facilities for craft getting alongside, workships will be provided on the main and upper decks, the storerooms reconstructed and enlarged, and the messing and hospital accommodation increased. Special attention will be devoted to the secondary armament and search-light equipment in order to ensure the maximum protection against torpedo attack, and she is also to have a wireless installation. The removal of the main armament and fittings from the upper and main decks will effect a saving of several hundred tons weight, and this will permit of the maximum amount of coal—1,800 tons—being carried. Our submarines have been attracting attention in Parliament, and on July 18 Mr. G. D. Faber, the member for York, inquired as to their cost compared with those building by Messrs. Vickers. He was informed by Mr. G. Lambert, M.P., that the work was not sufficiently far advanced to enable a reliable estimate to be given. It goes without saying that Chatham can build such vessels—or any others for that matter—quite as cheap as a private contractor.

Devonport Dockyard.

As already announced, August 24 has been fixed as the launching date of the *Téméraire*, and we are now informed that the naming ceremony will be performed by Countess Fortescue, the wife of the Lord-Lieutenant of the county of Devon. A record will probably be created for the yard in the launching weight of the vessel. Immediately after the launch the vacant slip will be prepared for the keel plates of another *Dreadnought*, one of those provided for in the current estimates. The ships, of which one is to be built here and one at Portsmouth, will be improved *Dreadnoughts*, and our vessel is expected to be begun about the end of September. The cruiser *Minotaur* has been moved to the South Yard to ship two 7·5 inch guns. It is expected that the dates fixed for her trials will have to be altered, as the motive power originally estimated for has been found to be insufficient, and an extra dynamo will have to be fitted. Fifty tons of patent fuel for the vessel have been received. The fuel, which is supplied in blocks, is composed of screened coal with a mixture of coal tar. The *Minotaur* is the first ship to be fitted for this kind of fuel. Work is going on in the boiler-rooms of the cruiser *Gibraltar*, and it is expected that about the middle of August the work will be completed. The boilers, which are cylindrical, will have been thoroughly cleaned, retubed, and scraped, and all fittings overhauled. In the cruiser *Cumberland*, which is being converted into a training ship for cadets to replace the *Isis*, considerable alterations are being effected. The ward-room is to become a study for the cadets, and the captain's cabins are being fitted as a ward-room. The commander's and navigating officer's cabins are being altered for the captain's use, and additional cabins are being constructed for the instructors and special officers. The ship is to be completed by the end of August. The arrival of the cruiser *Leander*, depot ship for destroyers, has enabled the cruiser *Blake* to proceed to Chatham, where she is to undergo the same process of conversion as the *Leander* has done. Stores and fittings were transferred from the *Blake* to the *Leander*, thus obviating the necessity for the latter vessel to draw on the yard during her stay here. A sad accident occurred on July 12 in connection with the salving of Torpedo Boat No. 99, which went down off Berry Head. A Portsmouth diver named Trapnell went down from the torpedo gunboat *Spanker* at 6.45 p.m. Owing to an entanglement of the diving gear, those aboard the gunboat could not haul him up, and his mate went down to his assistance, but it was not until 12.15 a.m. that he was able to signal "All Clear," and he himself was in a serious condition when he came up. Trapnell, who had been five and a half hours in 22 fathoms of water, was taken to Torbay Hospital, where he died. At the inquest a verdict of accidental death was returned, and the jury added a rider that the *Spanker* was unsuitable for diving operations in such deep waters, but that no blame was attachable to the officers. Lieut. Damant, of the *Excellent*, was in charge of the operations. Both the coroner and the jury praised the conduct of the diver Leverett who went to his mate's assistance. Two days later the destroyers *Lee*, *Blackwater*, *Leopard*, *Gipsy* and *Osprey* arrived from Queensferry where they parted company with the Channel Fleet, to which they had been attached. When about ten miles from Start Point, the *Lee* was in collision with the Dutch cruiser *Friesland*, which struck the destroyer on the port quarter, causing a considerable rent. Water rushed into the compartments, but was kept under by the pumps until a collision mat was obtained from the scout *Sentinel*, which was accompanying the flotilla. The *Friesland* offered assistance, but it was not required. One of the thirty ton electric motor cranes to be fitted at No. 8 dock at the Keyham Extension has arrived from Carlisle. The jib of the crane measures 55 feet.

Sheerness Dockyard.

It has been announced in the House of Commons that the Sheerness bar is to be dredged so as to allow of large warships passing into the river at half-tide. Lieut. D. J. Munro assistant to the commander of this yard, recently put before the Admiralty a scheme, and it is this which is to be carried out. He found that by adopting a new channel a uniform depth of 25 feet of water could be secured, with the exception of a few patches where there is 24 feet at low water spring

tides, and a small stretch of water at the eastern end of the bar. In the present channel there is only 20 feet of water on the bar at the shallowest part, so that a lengthy delay is often entailed. When the scheme is carried out there will only be a delay of five hours at low water spring tides for ships of heavy draught, while the port will always be accessible at neap tides. Another of the destroyers of the Fourth Flotilla has met with an accident which might easily have proved a disaster. The *Violet*, having had her port propeller replaced left at the beginning of July for a cruise with the flotilla, and on the night of the 9th was seriously damaged in collision with a sailing vessel. The destroyer was struck on the port side, the seamen's mess deck being crushed in for several feet, and a gap made from the upper deck of the forecastle to the water line of about ten feet. The *Falcon*, which had just rejoined the flotilla after nearly three months' absence whilst the damage she sustained in collision with the *Colne* was being made good, was with the *Violet*. She stood by to render assistance, and afterwards took the disabled vessel in tow, stern first, and steamed with her to the Nore, where she was met by the tug *Diligent*, which brought the *Violet* into harbour. Three of the crew received slight injuries. The damage is of such a character that the fore-part of the vessel in front of the bow gun will have to be practically rebuilt. Three other vessels of the flotilla—the *Cherwell*, *Colne* and *Panther*—are also in hand having their defects made good, as is also the *Exe*, of the Second Flotilla. We have been almost deserted by the Home Fleet during July. The battleships have been to Norway on their first cruise beyond British waters since the fleet was formed, and the cruisers have been cruising with the Channel Fleet. The vessels returned in the middle of the month, but only stayed a few days, as they left again for Torbay, where the three divisions of the fleet assembled under the orders of Vice-Admiral Bridgeman on July 22nd, to prepare for the Royal review at Spithead in August. The explosions which were carried out last year under the superintendence of the staff of the torpedo school ship *Actaeon* did not entirely disperse the wreck of the *Forte*, which was sunk at her moorings off Port Victoria. The hull was shattered, but the weight of coal on the timbers prevented them rising to the surface, and as their presence in the bed of the river is likely to result in further obstruction by mud silting around the wreck, arrangements have been made with the Whitstable Salvage Company to clear the wreckage away.

Pembroke Dockyard.

The first of the flat keel plates of the *Boadicea* was formally laid on the blocks in No. 5 slipway by Mrs. Kingsford, wife of the captain superintendent, on July 1. The plates had been placed at the head of an incline, so arranged that by pulling a lever the lady was able to set in motion an electric motor, which drew them on to the blocks; she then operated a pneumatic hammer, which knocked down the first rivet. The length of the vessel will be 385 feet, breadth 41 feet load draught 13 feet 6 inches, and displacement 3300 tons. She will be fitted with turbine engines of 18,000 horse power, the contract for which has been placed with Messrs. John Brown & Company, Clydebank. The vessel is a decided improvement upon the eight scouts. Her armament of five 4 inch quick-firers will be more powerful than that of the scouts, and she will have a greater radius of action. She is to have extra large bunkers and oil fuel will be carried in her double bottom. There is every reason to believe that the *Boadicea* will actually steam over 26 knots on her trials, and that the estimated speed of 25 knots will be actually obtained on service. She will consequently be a faster cruiser than any yet in existence in this or any other country, and her rate of steaming will enable her to keep pace with the majority of the nominal 30 knot destroyers. She is to be completed by December 1908. A report has been in circulation here that the Admiralty have decided to make provision for a new type of armoured cruiser to be laid down at this yard. From a local point of view it is to be hoped that the story is correct. An inquiry as to the amount of existing wharfage accommodation for the most recent types of battleships and cruisers has reached the yard from the Admiralty. The Admiralty are aware that the dock accommodation for big ships is limited but knowing that they will require repairs from time to time that will not necessitate the vessels being docked they wish to ascertain the present capabilities of each port in that respect. As the Admiralty also asked for a report as to what additional wharfage could be provided and the approximate cost, it appears as if they are desirous of extending the existing facilities. There is only one really safe berth here for the most recent types of battleships—the Carr Jetty—but Hobbs Point Pier could be made available at the cost of a few thousand pounds. Mr. Ollis, the chief constructor, who was recently appointed constructive manager at Chatham *vice* Mr. Black, has terminated his official connection with us, and has gone to Chatham to take up his new appointment. Mr. Pledge, chief constructor at Chatham, who will succeed him here, is not expected until the end of August, and during the interval the duties will be discharged by Mr. Worthington, the assistant constructor. Among small work being done is the construction of two large stages, or catamarans, to be used at Devonport for berthing submarines. They will be sixty feet long and built of wood.

The Engineering Standards Committee.—The Council of the Institution of Civil Engineers have appointed Sir William Matthews, K.C.M.G., president of that institution, to succeed the late Sir Benjamin Baker, K.C.B., K.C.M.G., as one of their representatives on the Main Committee of the Engineering Standards Committee.

Surveyors.—At the recent competitive examination held in London for surveyors to the Board of Trade, the position of first on the list was taken by a pupil of J. Hawthorn's Marine Engineering Academy, 41, East India Road, E. This makes the twentieth successful candidate who has entered the Board of Trade at home and in India during the twenty years the school has been established. Also at the recent examination for extra First-Class Certificate two of Mr. Hawthorn's pupils were successful in passing the first time of trial.

Change of Address.—Capt. Lionel L. Atherton has removed from 1, Crescent, Minories, to Bush Lane Chambers, Cannon Street, London, E.C., to where all communications should be addressed.

Mr. D. Boest Cjips, of the firm of Messrs. C. Cjips & Zonen, shipbuilders and engineers, of Dordrecht, Holland, has, we understand, been decorated with the Order of the Rising Sun 5th Class by His Majesty the Emperor of Japan. It will be remembered that the Japanese men-of-war *Kai-Yoomar* and *Nits sin* were contracted by Mr. Cjips' firm. Models of these ships have been presented to the Emperor, and in return the Emperor bestowed the distinguished Order which is seldom given to private individuals.

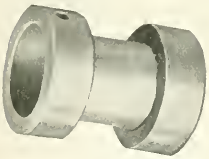
A new 40 ft. teak pleasure launch for the Nile is being designed by Mr. James A. Smith, M.I.N.A., of 47, Leadenhall Street, E.C. She will have a Lune Valley boiler and Savery engine.

The Combination Metallic Packing Co., Ltd., have sent us their latest list of war, merchant and passenger vessels recently built or building, fitted with "Combination" Metallic Packing.

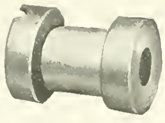
Queenstown. In the course of the annual inspection of dockyards by the Admiralty, the *Enchantress* arrived at Queenstown, when a deputation was received on board to advocate the necessity of improving the entrance to the harbour at Queenstown in order to provide for the large steamers using the port, and the still larger *Lusitania* and *Mauretania* about to use it *en route* between Liverpool and New York. It was also pointed out by the deputation that not only were the steamers of the mercantile marine increasing in size and taxing the Harbour Boards of the country to keep pace with them but the vessels of the Royal Navy were increasing and for their accommodation as well it was necessary to keep moving to give more draught of water and better entrance facilities. On the plea that merchant vessels contributed in dues towards maintaining the harbour, while the Royal Navy did not, the deputation expressed the hope that the Government would make a grant of money to assist in making the improvement proposed.

"DEXINE."

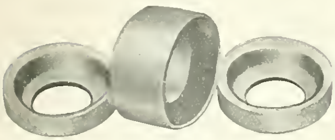
It may interest our readers if we give a general description relating to "Dexine," a material which was discovered some fourteen years ago, and has been on the market eleven years. It consists broadly of a combination of vulcanized indiarubber and other ingredients prepared by a special process in such a way as to give it exceedingly tough and frictionless properties, together with a valuable ability to resist the action of extreme temperatures. It will be admitted, we think, that it is not generally known that there are buckets that will withstand a temperature of 350° Fahr., or pumps for hot water would have been designed to use them instead of metal pistons, vulcanite rings and hemp packing, all of which are much more expensive than "Dexine."



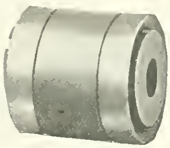
Ordinary Gun Metal Plunger, Spring Rings removed.



Same Plunger reduced.



Pair Patent Dexine Metallic Buckets with Intermediate Ring.



Ready for Mounting on Rod.

Fig. 1.

The material is supplemented by an anti-friction gauze or armouring, and buckets of this material can be put straight away into scored barrels, and have in practice considerably increased the utility of the pump, minus the expense of re-boring.

It is an extremely simple matter to convert existing pistons to take a pair of "Dexine" buckets, as will be seen by reference to the adjoining diagram (Fig. 1), which represeats the various stages. The first step is to reduce the diameter of the plunger to $\frac{1}{16}''$ smaller than the inside diameter of bucket. Then reduce the centre portion of plunger to admit of a bearing surface of not less than $\frac{3}{8}''$ all round inside the buckets, which is necessary to hold the buckets in position, and should be even more than $\frac{3}{8}''$ if the plunger will admit it. Next turn up the intermediate ring to a diameter $\frac{1}{16}$ less than the cylinder, and a thickness sufficient to allow the top and bottom plates to meet all except $\frac{1}{16}''$ when they are mounted on the rod and screwed home; it should *never be* more than $\frac{1}{16}''$, or in tightening up on the rod the buckets would be expanded sufficient to jam. In Fig. 2 we give a view of one of the large mills fitted with an 80 h.p. electric motor and installed at the works of the Dexine Packing and Rubber Co., Abbey Lane, Stratford, Essex. This view gives some small idea of the extensive plant necessary to manufacture this material.

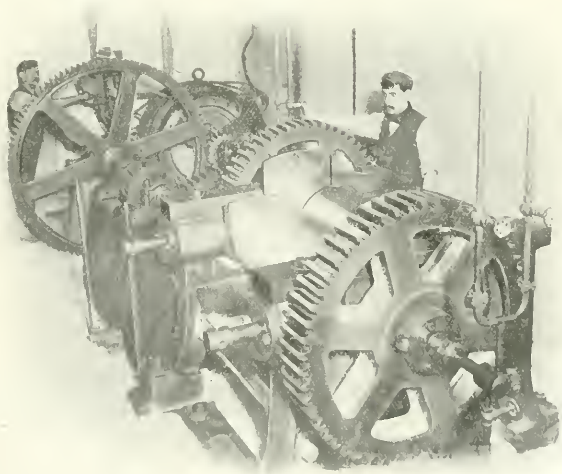
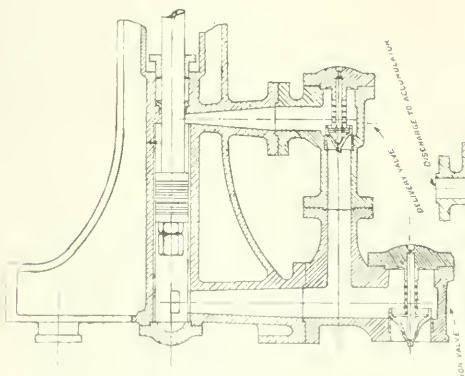


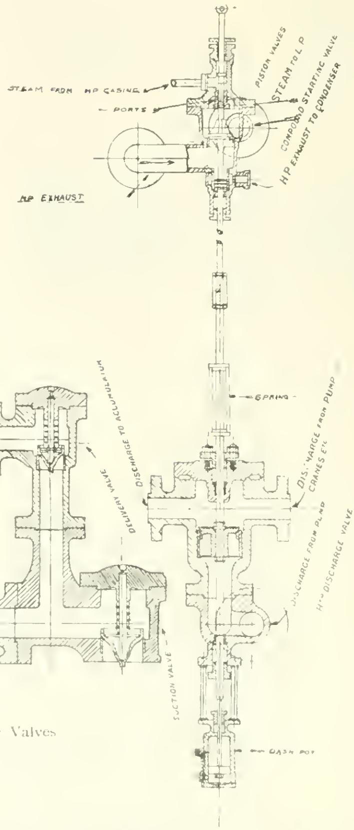
Fig. 2.

HYDRAULIC INSTALLATIONS.

Messrs. Brown Bros. & Co., Ltd., of Rosebank Iron Works, Edinburgh, the well-known manufacturers of steering gears, reversing gears and hydraulic machinery, supplied the hydraulic installations for the large new mail steamers of the Royal Mail Steam Packet Co., Southampton.



Pumps, Suction and Delivery Valves

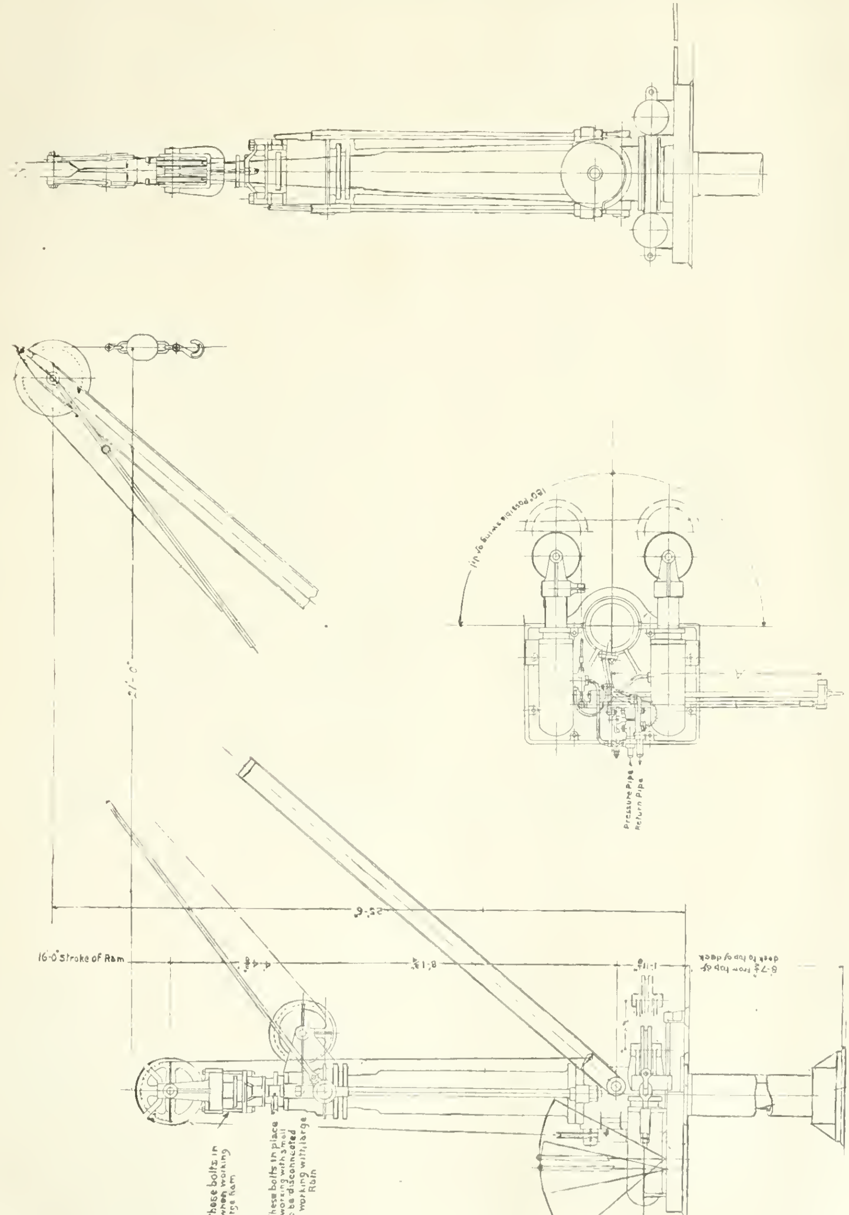


Details of Valves for Pumping Engine

These ships, which are known as their "A. Class," are justly renowned, not only for their magnificent and luxurious passenger accommodation, but for the splendid way in which they are fitted up with all the latest and most up-to-date improvements, which go to make what is known as the latest and best in naval architecture and marine engineering.

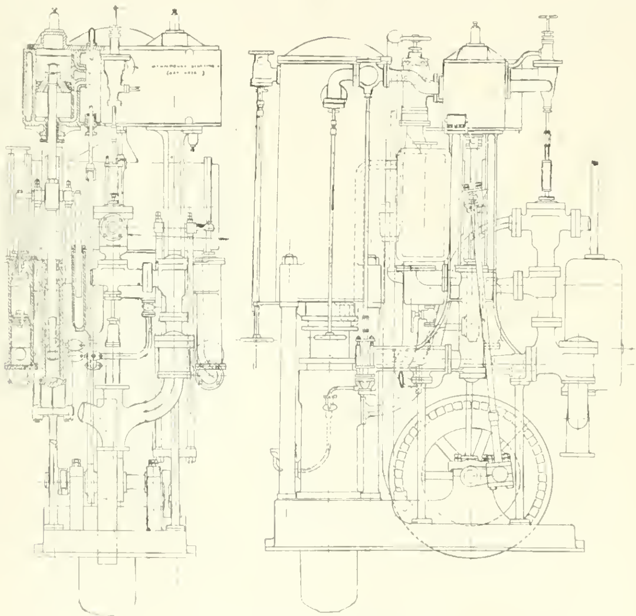
The hydraulic installations consist of an automatic compound inverted direct acting surface condensing steam pumping engine. The pumps, which are of the piston and plunger type, are driven direct from, and in line with, the piston rods. One of the accompanying illustrations shows the piston and plunger with its valve boxes. The air, circulating, and feed pumps, are also driven direct from the engine crossheads. A large steam accumulator is provided, which gives a water pressure of 1000 lbs. per square inch, for working the ten hydraulic cranes with which each of these vessels is equipped. The accumulator is fitted with a safety valve loaded by means of a spiral spring to slightly above the working pressure, so that the valve opens and allows water to pass back to the supply tank should the pressure rise above the working pressure from any cause whatever. There are two large supply tanks. One of these is supplied with water for working in temperate climates, and the other with a mixture of water and glycerine for use in frosty weather, so as to prevent damage to the cranes, pipes, etc., by frost.

As will be gathered from the illustrations, the



Two and Four-Ton Deck Post Crane.

arrangement of this engine with the accumulator is very compact, and is specially designed to occupy the minimum space possible with consistent and reliable working. All these features are, of course, very essential and important on board a ship of this class. The effective steam pressure at the engine is 200 lbs. per sq. inch. The surface condenser is situated between the back of the engine and the accumulator, and is of the usual marine design having brass tubes and tube plates, the former having their ends made tight with screwed ferrules and packings in the latest and most approved form. The exhaust from the engine passes into a two-way valve of special design, so that it can be turned into the condenser or force direct into the main pressure pipes and accumulator. The engines, although compound, having one H.P. and one L.P. cylinder only, start automatically, this being effected by this firm's arrangement of valves, particulars of which will be found on one of the illustrations. We may say that this valve works on the principle, that, when there is no flow of water from the pumps, the spring forces the spindles down and admits high-pressure steam to the low-pressure casing, at the same time shutting off the H.-P. cylinder exhaust from the L.-P. casing, and opening it into the main exhaust pipe, so that the engine becomes a simple or non-compound engine. Immediately the discharge from the pumps commences this

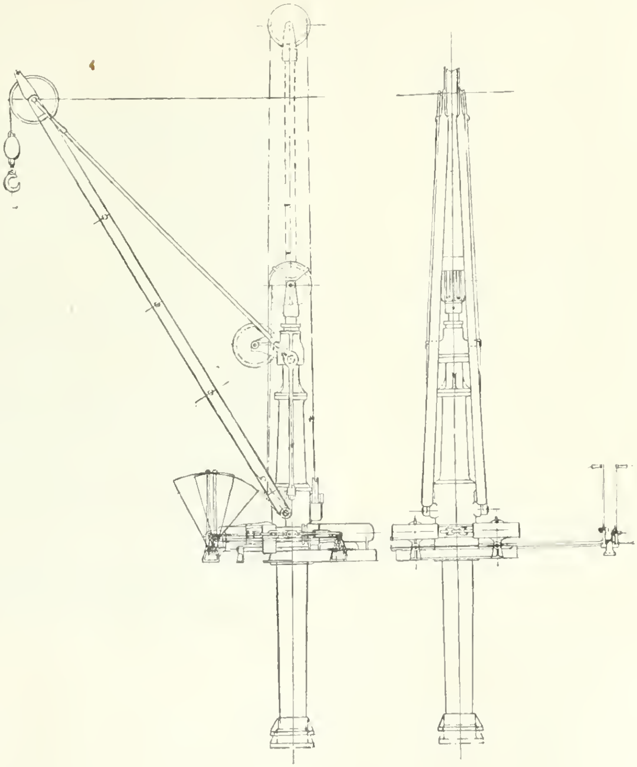


Arrangement of Pumping Engine.

the waste steam pipe as desired. As will be noted from the illustrations, the pump plungers themselves form a continuation of the piston rod, and the bucket, which is secured to the plunger, is made very deep, so as to prevent leakage as far as possible. The pump chambers are lined with specially hard gun metal. The two connecting rods are designed so as to clear the pump barrels, and although they appear light for the cylinders, it must be remembered that there is very little work required of them beyond the driving of the crankshaft and slide valves, etc., as the pumps being of the differential type, the load is practically equal on both strokes. The pumps take their water direct from the supply tanks, and valve lifts, and the engine becomes compound. The engine itself is regulated by the steam piston in the accumulator, and is so arranged that when the accumulator is fully charged the accumulator steam piston shuts off the steam from the engines, and the accumulator falling again, owing to water being drawn off at the pressure pipe, steam is again admitted to the engines. There is also fitted an ingenious form of hydraulic governor, which closes when a predetermined reduction of pressure is reached in the pressure pipes, and so prevents the engine from damage, should there be a burst in the pipes or other accident. It will thus be seen that the engine is perfectly automatic, starting and stopping according

to the demand for water, and regulating its speed according to the requirements at the time. The crankshaft has two bearings, and carries a heavy fly-wheel so as to insure steady working of the engines. This fly-wheel is notched on one side, and provision made for barring the engine round by hand when overhauling, etc.

All the five ships have ten cranes each, the majority of which are capable of lifting 30 cwts., and the remainder two tons. In the case of one ship, she is fitted with a crane having two rams, so that two to four tons may be lifted. With this latter crane there is a small ram working within a larger one, taking the load up to two tons, and the larger ram takes up to four tons. When working with the small ram the large ram is held down by two bolts, but when working with the large ram both rams are secured together by two bolts. The remainder of the cranes have one lifting ram only and two slewing rams, the latter being placed on the base plates and so arranged to slew the cranes through a maximum angle of 180 degrees. The lift of these cranes varies from sixty to over seventy feet. All the lifting rams are steel tubes covered with electrically deposited copper to prevent corrosion. The slewing rams are of cast-iron, and are similarly covered with copper. Non-rotative wire rope is used for lifting, while chains are employed for the slewing motion. The jibs of the cranes are composed of two rolled H. beams braced together by two tie rods. The levers for working these cranes are arranged at the most convenient positions for the man working them to see his work. The pressure and exhaust mains are led along the decks very unobtrusively, and are all of special lap-welded iron pipes. Ample allowance is made above the thickness required for pressure for rusting away. The pipes are connected together by flanges having two bolts; these flanges and joints being of the makers' special design. To avoid freezing the makers issue special instructions as to the proportion of glycerine required for various temperatures, and instruments are supplied for ascertaining the percentage of glycerine in the water at any time, and if attention be paid to this important item no trouble of any kind is experienced.



It is, of course, unnecessary to point out the great advantages that hydraulic installations for working cargo, etc., present for such ships as these. There is, of course, almost no noise or vibration; in fact, it is hardly possible to tell that the cranes are working when standing against them, or on decks underneath, except, by seeing the cranes themselves actually moving; and there are no hot steam pipes led about the decks—these items are, of course, great considerations in ships of this class where the comfort of passengers is the first consideration. The rate of working with these cranes is quite as fast as with steam winches, and the coal consumed is very much reduced. The initial cost is, of course, greater than in the case of an installation of ordinary cargo winches; but in ships of this class it is a small matter compared with the great advantages offered.

Another advantage of this type of crane is that no derricks or other fittings are required on the decks or masts, the cranes themselves being entirely self-contained, so that the masts are all neat, and gracefully designed, and they are raked so as to give the ship a good appearance. Where the derricks are attached to the masts it is, of course, necessary either that the masts shall have practically no rake, or the derrick heels have to be stepped on the deck, or other erection, which certainly not only detracts from the appearance of the ship, but encumbers the deck to a great extent.

ELECTRICITY ON BOARD SHIP.

XI.*

By Sydney F. Walker, R.N., M.I.E.E., Assoc. M.I.C.E., Etc.

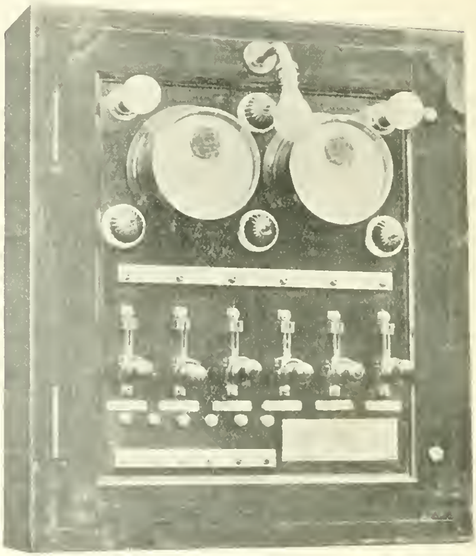
Distributing the Current.

The Three-Wire System.

As explained in a previous article, so far as the author is aware, the three-wire system has never yet been employed on board ship, but it is more than probable that it will be employed later on, as the use of electricity develops, and for the same reasons for which it has been employed on shore, though the reasons operate in a slightly different manner. Modern ships, especially the great ocean liners and modern battleships, are getting longer and longer, as each new design is got out, and what is very much more important, so far as the distributing cables are concerned, the system of water-tight bulk heads, closing off the different compartments of the ship from each other, is being more and more developed, and the difficulty of carrying cables through them is being more and more accentuated, and hence it appears to the writer that anything which can reduce the size of cables will be of advantage in the matter of distribution. For the same reason he believes that higher electrical pressures than are at present employed will be used as time goes on. He is quite of the opinion of those who have so far had the carrying out of electrical work on board ship, that pressures should be kept as low as possible, for the reason that insulation is difficult on board ship more than anywhere and that the difficulties of insulation increase rapidly as the pressure increases, also that danger from shock increases very rapidly with the pressure. On the other hand, as seamen become more and more accustomed to the handling of electrical apparatus, the danger from shock will be very much lessened. Even at the present time the danger of shock, say from a 500-volt service, is not a fraction of that incurred in the old sailing-ship days, by a man going down the leech of a topsail, say, to hook on the reef tackle. As the use of electricity develops also, the power required will steadily increase, as in every other case where electricity is employed, and unless higher pressures are used, and every means is taken of lowering the size of the cables, they will soon become of a very unwieldy character. Seamen know the trouble there sometimes is in handling a large rope hawser, which is made as flexible as rope makers can manage, consistent with giving it its proper strength—and they are also acquainted with the great difference between, say, strapping a block with a wire rope and a hemp rope, and they will easily understand how these difficulties increase as the size of the rope increases. To the writer's mind, all of these things apply to the cables employed for distributing electric currents. At their best they cannot be made very flexible, except in very small sizes, and as the sizes increase flexibility disappears very rapidly.

A parallel case also may be quoted. Mining work, in a great many respects, is very like board-ship work. There are the same reasons for keeping everything as simple as it is possible to make it. There are many of the same difficulties in the matter of insulation. There are the same, or even greater, dangers of shock than on board ship. The whole of the mine is often in the same position with regard to the electrical service as the whole of the ship is to a board-ship service. In mining work, 500 volts have been used for the last fifteen years, and pressures of even 3000 volts are now taken underground and what the writer has mentioned above is steadily taking place; mining men are gradually being accustomed to electrical apparatus, are becoming more and more able to take care of themselves, and though the pressures are steadily going up, for the same reason as the writer advocates higher pressures on board ship, accidents are becoming less and less frequent.

In mining work, also, the three-wire system, though not often used, is occasionally employed. The three-wire system was introduced by Mr Edison, in America, and the late Dr. John Hopkinson in this country, to enable the advantage of double the pressure to be obtained at the expense of a slight increase in copper, and the additional complication involved in the three-wire system.



Switch board for a small installation, made by Messrs. Clarke, Chapman & Co, for one dynamo and six distributing cables.

* For Articles I to X, see last ten issues.

In the three-wire system, as its name implies, there are three cables, known respectively as the "positive outer," the "negative outer," and the "neutral," and the service is worked at double the pressure of the lamps that are to be used upon it. Thus, in the early days of electric lighting, when only 100 and 110 volt lamps were available, the three-wire system was worked at a pressure of 200 and 220 volts. Now that lamps are available of 200 to 260 volts, the three-wire system is worked at pressures from 400 to 520 volts. The arrangement is as follows:—There may be two generators, each furnishing current at the pressure of the incandescent lamps, or a little over, connected together in series, so that the combined pressure of the two is double that of one of them, or a single generator may be employed, furnishing current at double the pressure the lamps are to work at, or a little over. As already explained, it is usual to work the generators at a little higher pressure than the lamps they are to furnish current for can work with, in order to allow for fall of pressure in the cables. With either arrangement of generators two sets of lamps are fixed, one set connected between the positive outer and the neutral wire, and the other set connected between the negative outer and the neutral wire, and the current passes from the positive side of the generator system, whether it consists of one or two generators, along the positive outer to the lamps on the positive side, through those lamps to the neutral cable, thence through the lamps on the negative side to the negative outer, and thence back to the generator system. The neutral cable merely performs the office of collecting the currents from the different lamps on the positive side, and carrying it to the different lamps on the negative side, and therefore, as it only has to handle a very small current proportionately, and sometimes none at all, it can be made very much smaller in section to either of the outer cables, and hence the advantage of the higher pressure is obtained for the service, in the size of the cables, less the amount spent in the neutral cable.

As will be explained fully in a later article, by doubling the pressure of the service the engineer is able to reduce the size of the cables for a given current to be distributed within a given radius from the generating station to one quarter of that at the lower pressure. Or put in another way, with a generating pressure, say, of 100 volts, it is possible to distribute a certain current, for a certain number of lamps, with a certain size of cables, within a certain radius from the generating station. With 200 volts the area may be quadrupled with the same sized cables, four times the number of lamps may be distributed within the original area with the same sized cables, or, if the area and the number of lamps is maintained the same, the size of the cables may be one-quarter of those required with 100 volts. On shore, in town services, nearly the whole of the systems are now worked at from 200 to 260 volts, the increased pressure from 100 and 110 volts enabling the engineers in charge of the systems to distribute over practically four times the area they could supply with the lower pressure. On shore, also, the three-wire system is largely employed, and this again nearly quadruples the area of supply with the same sized cables, and the same pressure, giving sixteen times the area over 100 volts and only two cables.

In the early days of electric lighting, when 100 and 110 volt lamps only were employed, it was usual to have two generators connected in series to furnish the double pressure, and the neutral wire was connected to the junction of the two machines. With this arrangement any "out of balance," as it is called, between the two sides of the system is furnished by the generator supplying that side. Thus, the engineer always endeavours to arrange that the number of lamps supplied on each side of the system is the same, and, as far as possible, that the number of lamps burning on each side is the same. On board ship this will be very much easier to arrange than on shore, because the requirements and their variations at different times of the day are so much better known and so much more under control. On shore, however, with the best arrangements that can be made, it often happens that there may be 250 lamps burning on the positive side, and only 220 on the negative, in a small system or, say 2500 on the positive side, and 2200 on the negative side, in the case of comparatively large generating stations or *vice versa*. In such a case, on the early plan, the positive generator of the two supplied the additional 30 lamps or 300, as the case may be, its engine furnishing the necessary power for the purpose, the negative generator providing the excess when it is on the negative side The more modern plan, however, is for one generator or one group of generators, working in parallel, to furnish the full pressure, and, in that case, what are termed "balancers" are fixed in connection with the service, the object of the "balancers" being to either transfer the necessary current from one side of the system to the other, to equalize the load between the two, or to furnish the required additional current on the side on which the load is greatest. The first arrangement is worked by what are called electrical "balancers," and the second by steam balancers. These will be described in the next article The illustration shows another of Messrs. Clarke, Chapman & Co's switch-boards, made for a small installation with one dynamo. The board, it will be seen, carries a volt meter and ampère meter, also six distributing switches of the single-pole type, and six double-pole fuses, that is to say, fuses on each of the distributing cables. One of the fuses for each cable forms practically a part of the switch for that cable, the other fuses being on the return cable, the whole six grouped together, as will be seen, at the lower part of the board.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

Wireless Telegraphy.

THE field for this branch is such a fruitful one that many minds have been concentrated in this direction since the first practical results were attained. Prominent in the researches is naturally the question of selectivity, or a prevention of interference in messages. To effect the desired object it is now proposed to use currents of different frequencies which, it is said, will make the matter independent of power and distance of transmission. Full accounts and diagrams are published of this system by the author, and that such should be the case goes to show that we may look forward to considerable developments in this direction in the near future.

Radio-Telegraphic Convention.

Meanwhile the Committee of the House of Commons appointed for the purpose of considering this matter has issued its report. One conclusion is that the Government of the day in supporting the Marconi Co. should have secured a right of pre-emption of the patents, and that the Post Office, in refusing support to other companies, has given the Marconi Co. a practical monopoly for a certain period. The advantages of ratification of the treaty are stated shortly to be that stations would not interfere with one another, that certain wave lengths would be reserved for naval use, and the effect of ratification would be also the general development of wireless telegraphy throughout the mercantile marine over which the Admiralty would have control in case of emergency. The colonies would be separately represented if need be, and the Government could retire from the convention, if necessary, by giving a year's notice. Though the Marconi Co. is against ratification it is proposed to award compensation if the Company suffer a loss during the first three years after ratification.

Electric Transporters at Liverpool.

Messrs. Applebys, Ltd., have recently supplied the Mersey Docks with six transporters, which are intended for the rapid handling of cargo and to run along the shed roofs, the front and back of the carriage being borne by running wheels moving on rails placed at the eaves and ridges of the dock-side span of the roof, the bottom of the carriage being therefore at an angle corresponding to that of the roof. The machines are capable of handling a working load of $1\frac{1}{2}$ tons at a maximum outreach of 47 ft. from the lower rail to a minimum of 3 ft. 6 in., the vertical lifting range being 70 ft. Each transporter has four motions—lifting, racking, travelling and hinging up the jib. In unloading when the load has been lifted to the required height, travel may be made inwards without having to stop the motor, and the sam

when being travelled outwards. The travelling gear is worked by an independent motor fixed on the lower sill. The motors are of the enclosed water-tight multi-polar type series—wound for a direct current supply of 460 volts. The jib-lifting gear consists of a worm and spur wheel, double-barrel winch, an automatic retaining brake being provided. The lifting and racking motor develops 32 B.H.P. at 500 revolutions, the travelling motor 5 B.H.P. at 500 revolutions, and the jib-lifting motor 3 B.H.P. at 1000 revolutions.

Variable Speed Motor.

This problem is one that always excites attention. Hitherto this has generally been accomplished by the insertion of a regulating resistance into the circuit of the shunt-field winding, but with greater applications more stringent conditions have been demanded, and this has furthered the development of the system based on the variation of the resistance of the magnetic circuit. There is no appreciable difference in the two methods as regards cost, but each case depends on its merits for which to select. For instance, if a motor is to be regulated from a distance the electrical resistance control is better, and in cases of machine tools the second plan is, perhaps, to be preferred. The latter plan is more mechanical, it being self-contained and not liable to get out of order. The application of electric drives to machine tools has brought into prominence the variable speed motor, and with it this question of the means to be employed.

Recent Reports upon Etheric Telegraphy.

We have already referred in this column to Mr. Poulsen's discoveries in this branch of science, and we have now before us some of his practical results. A site has been secured in Ireland and a station put up on this system, but with arrangements already complete tests have shown remarkable figures. With stations 1400 miles apart, messages have been received with great distinctness and very little loss of power, land as well as sea being passed over. Not only so but it is said duplex messages can be forwarded on this system, and printing take place as rapidly as an operator can transmit. The former advantage enables communication to take place both ways at the same time without interference. This is said to be due, on the Poulsen apparatus, to the low voltage employed. From the above it is obvious we should not be committed to any one system however successful it has been, and probably this will induce the Government to ratify the terms of the convention, which we understand is to be done.

The International Engineering Company and the Lovekin Pipe Expanding and Flanging Machine Company, of Phila., Pa., are about to merge into one large company of $3,450,000 capital, in order to build the necessary plant for the manufacture of the Lovekin machines.

The Institute of Marine Engineers paid a visit to the Great Eastern Railway Works on Saturday afternoon, June 13th. The next visit is to take place on August 24th, to the works of Messrs. Mumford, Colchester.

Sanitary Congress.—The following is a list of the papers read at the Sanitary Congress held under the auspices of the Royal Sanitary Institute (Parkes Museum, Margaret Street, London W.). Section I. "Sanitary Science and Preventive Medicine." Two papers, "Poor Law and Sanitary Administration in Ireland," by Sir Chas. A. Cameron, M.D., and "The Rôle of Sanatoria is a factor in checking tuberculosis," by Prof. E. J. McWeeney, M.A., M.D. Section II. "Engineering and Architecture." Two papers "The economic housing of the working classes in town and country," by Mr. P. C. Cowan, B.Sc., and "Could the existing statutory and departmental requirements as to sewage disposal be relaxed in certain cases with advantage to the community?" by Mr. W. Kaye Parry, M.A. Section III. "Physics, Biology and Meteorology." Two papers "The Climatology of Ireland in relation to public health," by Sir John W. Moore, M.D., and "Disinfection considered from a medical, chemical, and bacteriological standpoint" by Mr. S. Rideal, D.Sc. The list of delegates is a large one, representatives were present from most of the districts of England, Scotland and Ireland, while several societies were represented, municipal and engineering. The Institute of Marine Engineers was represented by Mr. Jas. Girvin.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Work and Play.—July, the holiday month as regards the iron and steel and the shipbuilding and engineering industries of Glasgow and neighbourhood, and Clydeside generally, has come and gone, and under long-waited-for-come-at-last conditions as to weather the Clydeside citizen and his wife and bairns have had a good rest from labour and are again in working harness. The eight or ten days by which the working month is abbreviated have, of course, the effect of lessening the tonnage sent off the stocks, but as a rule extra efforts are made before the advent of "the Fair Week" to finish off and consign to the water vessels which are nearing the launching stage. This year the increased output due to this assiduity was considerable, and amongst others two very notable ocean steamships were launched some days before the stoppage.

New Ocean Liners.—The Fairfield Shipbuilding and Engineering Co., Govan, consigned to the water on the 18th July the triple-screwed turbine steamship *Cairo*, built to the order of the Egyptian Mail Steamship Co., and a sister vessel to the *Heliopolis*, launched from the same establishment on May 28th last, and presently lying in the tidal basin of the firm being fitted out. These fine vessels are intended for this new company's passenger and mail service between Marseilles and Alexandria. Some days prior to the launch of the *Cairo* the firm of D. & W. Henderson, Partick, launched the twin-screw steamship *California*, which they have built for the trans-Atlantic service of the Anchor Line. The *California* is in all the main essentials a repeat of the *Caledonia* produced by this firm for the same service last year.

Canadian Lake Steamers.—Another steamer launched from the Fairfield works—which it is worthy of note have now not a single vessel on the stocks—a few days prior to the *Cairo* was the *Keewatin*, a sister ship to the *Assinobia*, sent off the stocks the previous week. These vessels have been built to the order of the Canadian Pacific Railway Co., and are intended for service on the great Lakes of America. An interesting feature of the vessels, whose dimensions and general description will be found in the launches section of this issue, is that they have been specially constructed with a view to their being divided amidships to allow them to pass through the locks of the various canals on their way to the Lakes.

Cunard Liner "Lusitania."—This great twin screwed turbine propelled liner left the tidal basin of her builders, Messrs. John Brown & Co., Clydebank, on the forenoon of June 27th, and under her own steam, with six tugs in attendance, safely navigated the confined and somewhat tortuous, and none too deep, channel of the Clyde, arriving safely at the deeper and open waters of the Tail of the Bank without hitch of any kind. The Clyde Trust and the Clyde Lighthouses Trust co-operated with the enterprising builders, and for months in advance prosecuted dredging, and on the day of the departure there was a uniform depth of channel of 23 ft. at low water and 33 ft. to 34 ft. at high water all the way from Clydebank to below Port Glasgow. Fortunately the wind was favourable to a good tide, and thus at many points a depth of 34 ft. was available. The vessel when she left the builders' dock was drawing 28½ ft. forward and 29½ ft. aft, and only the better part of two hours was occupied on the short but responsible "maiden voyage" of fifteen or sixteen miles. The huge vessel answered her helm with more than usual promptness when the two inner propellers were used in going down the river, and this same quality of quick steering was noticeable on the preliminary trials which followed two days after at practically all powers with four propellers working. On two separate days before engaging in trials the vessel was thrown open to public inspection, and was largely taken advantage of, the proceeds of the shilling charge of admission going to charities. The preliminary trials which took place on the measured mile off Skelmorlie, and over greater distances on the Firth, while only intended to test the satisfactory working of the main

the men. To raise wages in a time of declining trade would be suicidal, and we are glad to observe that the head official of the Engineers' Society has seen this matter from the right point of view. It is, we believe, largely due to the strongly-expressed advice of Mr. Barnes, their general secretary, that the engineers' demand was withdrawn, and without that advice they might now find themselves engaged in a struggle which could only end in ruin. It is indeed a hopeful augury for English trade when we find the leading officials of trade unions having the moral courage to give their constituents honest advice, even though at the time it may be unpalatable. Several other sections of operatives had put in claims for advances, subsequently to the engineers' demand being made, but after the withdrawal of the latter it may be taken for granted that those other claims will be permitted to lapse.

Work in the Yards.—Messrs. Armstrong, Whitworth and Co., who recently launched a large steamer for the Bucknall's South African line, have now on the stocks four vessels of large size, all of which are in the framing or plating stages, and arrangements are being made for placing the keel for another. In the adjoining yard of Messrs. Dobson & Co. (who recently launched a steamer for service on the Canadian Lakes), there are two vessels building, one of which is well advanced towards completion. Messrs. Hawthorn, Leslie and Co. are well supplied with work, both in the building and repairing departments, and at Messrs. Stephenson's yard, we notice that one of the recently vacated berths is now occupied by a keel. In the graving dock the floating workshop *Cyclops*, which Sir James Laing & Sons have built to the order of the Admiralty, is receiving certain necessary finishing touches, preparatory to being handed over to the Admiralty officials for final equipment. It is understood that the dock is engaged for the reception of another important vessel requiring an extensive overhaul as soon as its accommodation becomes available.

The Cunard Steamer "Mauretania."—In a very few weeks this great vessel will be ready for her trials, and in the meantime she is an object of great interest to the thousands of persons who pass her in the river steamers daily. It is announced that before leaving her present position beside the yard of the builders, the vessel will, for a time, be open to public inspection. A charge will, of course, be made, and the proceeds will be applied to the assistance of local charitable institutions. Messrs. Swan, Hunter & Wigham Richardson, Ltd. (the builders of the *Mauretania*), have a good deal of other work in hand including a couple of pontoon docks for different destinations. In the repairing department they are exceptionally busy, a recently secured contract being the overhauling of the steamer *Pretoria*, which has been purchased by the Khedivial Steam Navigation Company, for service between this country and the Egyptian ports. Though the Northumberland Shipbuilding Company have one or two berths vacant, they have still as much work in progress as almost any other firm on the river, and at Messrs. Readhead's yard there is also a good show of business. The Smiths' Dock Company continue to be very busy in new and old work.

The Palmers' Company.—We note that this company's splendidly equipped yard is still somewhat bare of work; but notwithstanding this circumstance there continues to be a large force of men employed, the fitting out of the *Lord Nelson* (battleship) requiring the services of quite an exceptional number. The Company's steel works and engineering departments are busy, and it is stated that business in the forging department is fairly brisk. The designing department is also understood to be pretty fully occupied, which circumstance gives ground for the expectation that the empty berths in the yard will soon be filled.

The Engineering Trade.—In the larger marine engine establishments the pressure of work is steadily lessening and at each week end a number of hands are added to the unemployed section, which is now much larger than at the beginning of the year. The "turbine" works at Wallsend are fully supplied with orders, and the activity is likely to be maintained throughout the year. Manufacturers of steamship auxiliary machinery are now finding it difficult to replace work going out by new orders, and foundries are not so busy as they were. There are exceptions, however, and among them may be mentioned Taylors' foundry, Tyne-dock, to which a new wing has recently been added.

THE WEAR.

(From our Own Correspondent.)

Work in the Shipyards.—Messrs. Sir James Laing & Sons have commenced the construction of a petroleum-carrying steamer ordered by foreign owners, and in connection with this contract, we understand, that a new method of connecting the frames with the shell plating is to be employed. Six more barges for the River Plate Service have been ordered, and these are now being constructed in the west yard. Messrs. Doxford's berths are all filled, thanks to the popularity of the "turret" design, introduced, as our readers know, by the firm several years ago, and which has since obtained a large amount of attention from shipowners at home and abroad. Messrs. Short Bros. have three vessels on the stocks one of them being of exceptionally large size, and Messrs. Priestman & Co., on the opposite side of the river, have an equal number in hand. Messrs. Pickersgill's yard still presents an appearance of great slackness, there being no vessels on the stocks; but it is hoped that this state of matters will soon be changed. Messrs. Robert Thompson and Sons' Southwick yard is busy, and at the firm's Bridge Dock yard an extensive overhaul of the locally-owned steamer *Perseverance* has just been carried out. The yards below Sunderland Bridge remain, on the whole, fairly well employed, the North Sands yard being the busiest.

The Palmers' Hill Works.—At Messrs. John Dickinson and Sons' establishment, Palmer's Hill, there is little change to note since last month, but we have noticed at the wharf recently one or two new steamers being fitted with their machinery and an old vessel from which the machinery had been taken out for repairs. The Scotia Engine Works are still pretty busy, and at the North-Eastern Marine Works all departments continue to show full activity. Messrs. Doxford's engineering department is also actively engaged, but we hear that this is not the case at the Southwick Engine Works, where the work in hand has diminished considerably within the past few weeks.

Motor Engines.—We understand that Messrs Lindsay, Carverhill & Co., of the Wear Engine Works, have received an order for two large motor engines of the special type manufactured by them, which are to be fitted in a twin screw traffic barge for service in British Guiana. The new wing, comprising well-equipped workshops and offices, that has recently been added, is now about ready for occupation.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

Ship Canal Progress.—The first sod of the Manchester Ship Canal was cut at Eastham by Lord Egerton of Tatton, on November 11th, 1887; water from the Mersey was admitted into the Eastham section on June 18th, 1891; and the first flotilla of traffic passed along the canal on the 16th of the following July. The formal opening of the Canal was declared by the late Queen Victoria in 1894. That year the traffic receipts amounted to £97 901. Last year the receipts reached nearly half a million.

Dredgings in the Mersey.—Since 1889, up to May last, the quantity of sand removed from the bar of the Mersey, Crosby Channel, and other points, was nearly 100,000,000 tons. The minimum depth of the bar channel at low water and spring tides is 28 feet. It has been decided to construct a dredger of 10,000 capacity, provided with a pumping power equivalent to nearly three times that of any of the existing dredgers.

Scotch Ship Canal.—Men of thought in Scotland can see the advantages that accrue from water carriage, and they are now favouring construction of a ship canal between the Forth and the Clyde. The most acceptable route, it appears, is between Grangemouth and Yoker. The cost would be about £7,000,000, and it will create no surprise when we state

that it is suggested the Government should undertake the scheme as a "duty."

Unsanitary British Ships.—At the last meeting of the Manchester Port Sanitary Authority, Dr. Dearden, the medical officer, said he thought the difficulty they had had in regard to the imports of grain unfit for food had been overcome. All the people who had grain in a bad condition had made arrangements to dispose of it to the satisfaction of the authority. During the past month, 16 tons 4 cwt. of imports, including 12 tons of grain, had been declared unfit for human consumption. Of 232 vessels inspected at the port, 97, including 34 British vessels, were in an unsanitary condition.

Grain Imports.—The imports of grain to Manchester Docks during the present season show a considerable increase as compared with previous years. The stock at the elevator amounts to over 60,000 tons. The total number of bales of cotton which have been shipped to Manchester this year is about 660,000, 100,000 in excess of the number at this time last year.

Increased Canal Traffic.—The first six months of the present year show an increase in our Ship Canal traffic. The receipts exceed by £14,864 the amount received up to the corresponding date in 1906.

A View of Manchester Trade Prospects.—Mr. E. H. Langdon the president of the Manchester Chamber of Commerce, at the meeting of the Chamber this month, took rather a pessimistic view of trade prospects, which does not seem to be borne out by the facts. He said a change had come over the staple industry of Lancashire, although for the first five months of the year the exports of yarn and of cloth showed decided increases over the previous record year. At present there were no influences at work which could lead members of the Chamber to hope for a continuance of a similar increase in trade. It was true that spinners were fully employed on old contracts, and this production being absorbed by the looms of this country and the foreign demand they still retained a good margin of profit. But order lists in the hands of manufacturers were smaller in bulk than at any time this year, and short time would have to be worked in the weaving trade. No doubt the position of spinners had been strengthened by the increased shipments to the Continent. Germany, Holland and Austria had taken over £11,000,000 worth more than in 1905, but what would occur when this extraordinary demand abated? By the end of this year probably all the 102 new mills with their 9,000,000 spindles would be at work. At the same time it was to be borne in mind that our exports of textile machinery were increasing. Although at the present moment there was an almost entire cessation in the demand for cloth, still the shipments for this year had greatly exceeded those of 1905. Egypt, Turkey and Brazil showed the largest increases.

An Important Organization.—On the 18th inst. a large and representative gathering of shippers, merchants and commercial men generally was held in the Town Hall, Manchester, in order to form an association for the furtherance and protection of the interests of merchants and manufacturers engaged in the importing and exporting trades in this city. Speeches were delivered by the Lord Mayor (Mr. Harrop), by Mr. E. B. Trediver, chairman of the London Australian Merchants' Association, Mr. C. W. Macara, Mr. F. Collier and other gentlemen, including Mr. J. K. Bythell the chairman of the Manchester Ship Canal Co. The Lord Mayor pointed out that the day had passed when they, as Britishers, could afford to imagine that they had the entire trade of the world. There were other people than themselves and if they were to maintain the high position they held at present, it was only by being ever on the watch tower and arranging their trade shipping and commerce generally to be in harmony with the times in which they lived. They all realized that the keen competition which existed between Germany America and the United Kingdom would in nowise decrease and it was urgent and important that such an association as was contemplated should be formed. It would tend to develop the oversea trade of the country. Mr. Trediver pointed out that in Germany goods from inland towns were carried at a weight rate. In this country without any inland carriage the weight rate amounted to 70 per cent. more. Mr. F. Collier, an exporter to the Colonies, said it had cost him 30s. per ton to ship goods from New York to Australia *via* Liverpool, while Manchester goods, which were sent by the same vessel from Liverpool, were charged 42s. per ton. Mr. Bythell said shipowners preferred to deal with united bodies in these matters. A resolution to form an association of the kind suggested was carried with enthusiasm, and the necessary steps were taken to bring it prominently before the public.

Iron and Coal Trades.—The pig iron trade in the County Palatine during the month has been on the whole steady, but with little business passing. The exports of raw metal have been considerable, and this serves to keep prices on something like a level plane. Exports of engines and textile machinery total strong figures. We are sending machinery, especially textile machinery, all over the world. There is also a considerable expansion in electrical machinery, particularly among English municipal and urban district authorities. Prices of pig iron during the month have wobbled a little, and the same may be said of manufactured iron. Steel has continued firm. Average quotations of pig and manufactured iron are about as follows: Scotch metal: Eglinton, 73s.; Dalmellington, 72s. 6d.; Glengarnock, 76s.; Gartsherrie, 76s. delivered Manchester docks; 2s. 3d. less per ton if delivered at Heysham or Fleetwood, and 1s. less if landed at Preston; Middlesborough G.M.B., 65s. 9d.; Derbyshire, 65s.; Staffordshire, 63s. 6d.; Lincolnshire No. 3, 64s. 6d.; ditto foundry, 63s.; ditto, forge, 61s.; Hematites (west coast), 77s.; ditto, (east coast), 80s. 6d.; billets £6 2s. 6d.; scrap iron, about 62s. 6d.; seamless copper tubes, 13½d.; braized ditto, 13¼d.; and seamless brass tubes, 10⅞d. per lb. Manufactured iron: iron bars, £8 per ton; steel rounds and squares £7 17s. 6d.; flats, £7 5s.; angles, £7 2s. 6d.; tees, £7 7s. 6d.; joists, £7; channels, £7 10s.; iron hoops, £8 7s. 6d.; steel boiler plates, £8 12s. 6d.; ditto, ships' plates, £7 10s. to £7 15s. The coal trade continues remarkably firm. The weather up to the last fortnight has been excessively wet and abnormally cold. Household fires have been a necessity. Prices, instead of falling, have increased, not only for house coal, but for all classes of burgy, slack and engine fuel, as well as for gas coal and cannel. The export trade also continues good. The railway companies of the United Kingdom have been taken aback by the rise in the coal market. They probably attached little importance to it at the beginning, not deeming that their large contracts would be affected, but they now find they cannot renew on the old terms, and are striving, with other large consumers, to break down the united front of the colliery owners. The colliery proprietors are really at present masters of the situation. The operative miners are asking for another increase of 5 per cent. in wages, which the Coal Conciliation Board have now under consideration. Average prices of coal at the pit's mouth in the Manchester district are as follows: best house coal, 14s. 6d. to 15s. 6d.; secondary 13s. 6d. to 14s.; common, 10s. 6d. to 13s.; burgy, 9s. 8d. to 10s. 4d.; best slack, 8s. 10d. to 9s. 6d.; medium 7s. 10d. to 8s. 6d.; lower qualities, 7s. 4d. to 7s. 9d.; coal for shipping, 12s. 6d. to 13s. 6d. f.o.b. at Garston. Furnace coke in good demand at hardening rates.

THAMES.

(*From our Own Correspondent.*)

London Dock Accommodation. This question has again been brought to the notice of those interested by a paper read by Lord Pirrie in the Harbour section of the recent conference held at the Institution of Civil Engineers. No one is more conversant with the subject than the author and it was put forward that London though reputed to be the first port in the world, had no dock large enough to take a vessel of the *Dreadnought* class, which, in consequence deprived Thames shipbuilders of the chance of obtaining orders for reconstruction or repair of such vessels. He said no ship drawing more than 24 ft. could come up to Gravesend at all states of the tide vessels having to anchor until the tide had risen sufficiently to enable them to cross the shoals between the Nore and Gravesend. It was urged that the State should come to the assistance of dock authorities to provide such necessary accommodation, and that instead of the Government building docks at their own ports these should be provided at the important shipbuilding and engineering centres.

Shipping Trade. The report of Messrs. Furness, Withy and Co. just issued, shows that the improvement noted last

year continues. The profits with the amount brought down being £372,936 or an increase on last year of about £25,000, after allowing for depreciation, insurance and repairs. With the preference and debenture charges, a balance dividend on the ordinary shares of 5 per cent. is recommended, a bonus of 5 per cent. and with the interim dividend making 10 per cent. for the year, carrying forward £49,019.

Australian Mail Contract.—The delay in this matter to which we have previously referred has led to the cancelling of the contract by the Commonwealth Government. The tender of the syndicate was accepted twelve months ago but not a ship has been laid down, and now we understand an agreement has been entered into by the Government with the Orient and Royal Mail Companies to carry on the service for a further period of one year after the expiry of their present contract on January 31st next. Fresh tenders have been invited by the Government for a mail service to begin on March 1st, 1908. Meanwhile, Messrs. Harland & Wolff are building a vessel for the Royal Mail S.S. Co., to be named the *Asturias*, which will be employed in this interim service.

Merchant Shipping Acts.—A select committee of the House of Lords has had under consideration amendments to these Acts, the object of which is to extend to owners and hirers of barges and similar craft, provisions of those acts which limit the liability of shipowners in cases of loss or damage. It is said the Association of Master Lightermen has about 10,000 barges on the Thames, and that accidents have been invariably due to ships' navigation and not the fault of these small-craft. Eighty per cent. of the traffic is said to be by their barges and lighters and that the trade is peculiar to the port of London. Such an important trade has at last made itself felt and asks that the injustice under which this branch suffers should be remedied.

Lloyds' Register.—Sir John Glover, who has for the past eight years filled the position of chairman of this body was entertained recently to a farewell luncheon, at which his successor, Mr. James Dixon presided. Among those present were Lord Pirrie, Sir John Gunn and Captain Inglefield, R.N. In a speech, the late chairman said that since he became a member of Lloyd's Register Committee, thirty-five years ago, the tonnage classified had increased from two to twenty million tons and the surveying staff had grown from seventy-five to over three hundred.

Thames Navigation.—We are reminded of the difficulties of passing up and down the river by the notices posted by the Conservancy respecting obstructions, while the widening of the Blackfriars Bridge is in progress. The first important operation in connection with this new structure has taken place in the lowering into position the first caisson of those that will form the foundation. This bridge will when completed be 30 ft. wider than formerly, or 105 ft. between the parapets. With the crowded state of the river navigators have a somewhat difficult time, as is shown by the turbine steamer *Kingfisher* being summoned by the Conservancy for travelling at too high a speed and overturning two watermen's skiffs by the wash of the vessel at Gravesend. There were the usual disputes as to the speed but the Bench fined the captain of the vessel. The Council with their steamers by no means find it easy to regulate their traffic and difficulties are continually being met with and breakdowns of the service occur. On a recent occasion, passengers had to wait an hour for a boat at Westminster.

Ordnance Factories, Woolwich.—Trouble still continues at this establishment owing to the recent discharges and short time put on, and a strike has been threatened. The trouble is chiefly in the Royal Carriage department, in which 5,000 men are employed. The matter remains in an undecided state. Meanwhile a conference of four Members of Parliament has been held and these gentlemen have recommended other Government work now given out to contract to be manufactured at the Arsenal. The minimum number of men recommended by the superintendent for employment in time of peace has been already reached, but reductions still go on. It is proposed to do away with the Royal Carriage department entirely and amalgamate it with the gun factories, thus saving in the cost of administration, and further similar changes are reported to be in contemplation in other departments.

The Imperial College of Science.—The Royal Charter for the Incorporation of this new College has been duly promulgated. The purpose of the new institution is to give the highest specialized instruction and to provide the fullest equipment for advanced training and research in the various branches of science. The Crown will control through the President of the Board of Education. On the governing body, of whom Lord Crewe is nominated chairman, we find the names of Sir W. White, Dr. F. Elgar and Sir A. B. W. Kennedy. The names and constitution of the governing body being so varied should command success.

London's State Barges.—It is said that two state barges, used in former times by the Admiralty for communication from Whitehall, are lying at Deptford Victualling Yard and may be broken up by the City Corporation for firewood. The decorations of these barges and their lines are described as of the highest class. It is said no actual orders have been given for their demolition, so that we may yet hear in these days of revival of their being utilised for purposes of show in some way. Anyway they stand interesting relics of a past age.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow.—Very little change can be noted in the position of the shipbuilding trade of this district during the past month, except the fact that there has been a marked growth of activity in the shipbuilding department of Vickers, Sons and Maxim's works, in consequence of the new orders in hand which were recently booked having been so well forwarded that men are now employed on them in all departments. It is felt desirable to keep all the branches of the works as fully employed as possible, and if the orders of the type which these works were specially designed to undertake do not come to hand, that smaller orders of all classes should be secured with the view of keeping together the men in inactive times, so as to be ready for the more important orders when they come to hand. This is admittedly a difficult thing to do at all times, but it is nevertheless desirable to keep good men employed so that they may be available when important Admiralty orders are to hand, either for the home or for foreign governments. Barrow in this sense is not so well off as yards situated on the Clyde and the Tyne, because if there is not much work at one yard there is invariably plenty to do at other yards in the neighbourhood, and men can generally find employment without having to move their families to other districts. The experience of Barrow builders is that a very large number of their employés live in lodgings and keep their families elsewhere, where in many cases the sons and daughters find employment at various avocations which do not exist at Barrow. The need of new industries in Barrow which will find employment for girls and young women is very well known, and until these can in some way be furnished Barrow will not be able to consolidate itself as much as is desirable, either from a shipbuilding or from other points of view. This question is exercising some attention, as it is looked upon as a very desirable thing, but first of all it is necessary to find out industries which will afford reasonable hope of being profitably worked, and secondly, it is also necessary to get together the requisite capital for the purpose. There will be no difficulty in the latter once it is shown that the movement proposed is on commercial lines.

Work in Hand.—No new orders are reported this month in the shipbuilding trade, but builders have been on the outlook for new business, and some of the negotiations which have been going on have advanced a step or two towards realization. What Vickers Sons & Maxim want are orders for big warships, but in looking out for these they know they have to compete with many other firms which have adapted themselves for the same class of work. There is a growing competition in this as in all other businesses and all firms are on the alert for orders which may be in the market. The local firm is perhaps better equipped for the building of warships than any other in the country by reason of the enterprise they have shown in the expansion of all departments of manufacture, and by the up-to-date equipment they have adopted on all hands. This work of expansion and equipment is continually proceeding, for the firm is

ever ready to adopt new ideas which are known to be an improvement on old methods, or which will lead to more economic and more satisfactory output. In these matters it is, of course, the survival of the fittest, and in the latter sense Vickers' are determined to be at the front. They have now in hand a Brazilian battleship of the *Dreadnought* type, a 25-knot turbine steamer for the Isle of Man Steam Packet Company, to be ready for next season, three steamers for the London and North-Western Railway Company, one of them a passenger vessel and two for the carrying of general cargoes, including cattle, an Indian survey steamer, a Mexican transport steamer, and a tug boat and a barge for the Furness Railway Company. The Indian survey steamer and the tug boat and barge for the Furness Railway Company have already been launched, and are now being fitted up in the Devonshire Dock. It is expected that the three London and North-Western steamers will soon be launched. It is probable that during the month of August other orders will be booked, and the prospect is that these orders will include some important work which has been in progress of negotiation for some time past.

Submarines.—A question was asked in Parliament on the 18th of July as to how it was that the order for seven submarines had been given out to Vickers, Sons & Maxim by the Government since they came into office, while none had been given to any other firms. The answer on behalf of the Government was that the firm of Vickers had devoted much attention to this subject, and that the Admiralty were prepared to receive designs of submarines likely to be of service to the Navy from other firms. It was not, however, stated that the Holland submarine patent had been purchased by Vickers, Sons & Maxim, and that this design had been adopted by the Government. Further, this design has been frequently improved by the builders on the basis of the experience gained and the scientific treatment of the subject, as proved by the fact that the originally A class was superseded by the B class, which has since given way to the C class, and subsequently to the D class, which is now being constructed at the Vickers' yard. Three of these vessels are now being built at Barrow, and some of them are being built by the Admiralty. It naturally follows that if other builders tendered for the Holland submarine they would have to pay royalties to the Vickers' firm, or, of course, it is quite open for them to introduce some better type of boat. Seeing the experience the Barrow firm has had it is not likely any other firm would be successful competitors unless they brought out a vessel of a different design altogether. These submarines are built *in camera*, and their design and their features of construction are kept a secret alike from other Powers and also from the trade.

The Russian Cruiser "Rurik."—The speed trials of this Barrow built vessel have been proceeding during the month on the Clyde, but at the time of writing they have not been completed, and therefore it is undesirable to comment on them. So far as is known, however, they have been highly successful and the speeds gained have been an increase on the specifications and on the horse power contracted for. This is the most powerful cruiser yet launched.

Steel Trade Combine.—There has been much written of late as to a combine in the steel trade in which Vickers', Armstrong's, John Brown's Cammell and Laird's, the Weardale Steel Company, Nettlefold, Guest & Company and other firms were said to be members. The object of the combine was stated to be to act as a bulwark against the growth of foreign competition, but the fact of the matter is that no such combine has yet been contemplated and it would be difficult to see how it would act to mutual advantage with such firms as were named, as their interests were not in common. There may possibly be some day a combine including those who build ships or produce shipbuilding material, as there is at present a combine of steel rail makers, but nothing of the sort is in the air yet, although it is freely stated that the recent combine of the firms of Harland & Wolff of Belfast, and John Brown & Company at Clydebank, may be the forerunner of a still more important grouping of firms in the shipbuilding trade. Of this more anon.

Engineering.—Considerable activity is reported in the engineering establishments in this district and new work having been introduced to the shops more hands are being employed in marine work. There is continued activity in the gun-mounting department, and every prospect of the present briskness being continued for some time to come. Boiler-makers are busier.

West Cumberland.—The shipbuilders in West Cumberland are busily employed on small but profitable orders. They seem to get a general steady run of work, and as soon as they launch one vessel they put another down on the stocks, and thus keep together their men better than is possible in larger establishments. Both at the Workington and the Maryport shipyards the same general activity prevails.

Shipbuilding Material.—There is a much better and more regular demand for shipbuilding material than for a considerable time past, and the plate mills at Barrow are kept fully employed. The requirements of users include not only large deliveries of plates but of sectional steel for shipbuilding purposes, and good prices prevail. Ship plates are at about £8 per ton net cash.

Hæmatites.—A stronger tone is reported in the hæmatite iron trade, and the prospect afforded is one which indicates the continuance of a full demand for some time to come. Prices are firm at 81s. for maker's iron net f.o.b., and 78s. for warrants net cash sellers. Stocks have been reduced to 17,479 tons in warrant stores, and makers hold practically no stocks at all.

Shipping.—The exports of pig iron and steel from west coast ports this year to date have reached 517,907 tons, being an increase of 74,537 tons on the corresponding period of last year. Freights steady.

SOUTHAMPTON.

(*From our Own Correspondent.*)

The Stranding of the "Cerera."—Mr. Justice Bargrave Deane, sitting in the Admiralty Division of the High Court, on the 2nd July last, tried a series of claims for remuneration for salvage services rendered to the above vessel, which ran aground on the night of the 14th April last at St. Alban's Head. As reported in our Southampton notes for July, the vessel was taken there for temporary repairs, after which she proceeded to the Tyne. The value of the *Cerera*, her cargo and freight amounted to £72,000. Claims were made by the owners, masters and crews of the *Petrel* and *Verne* of Dartmouth the *Queen* and the *Monarch* of Weymouth, the *John Bull*, Antwerp, and the *Greencastle* belonging to the Western Marine Salvage Company. Mr Henry Burden, Lloyd's agent at Poole, also claimed, and the Court made the following awards:—The *Queen*, £1500; *Monarch*, £2000; *Greencastle*, £1800; including claim for damage she sustained; *Petrel*, £1200; *Verne*, £1300; *John Bull*, £2000, and Mr Burnden, £200; total £10,000

Messrs. J. I. Thornycroft & Company, Ltd., launched the ocean going torpedo boat destroyer *Tartar* from their Woolston Yard on the 25th June last. The launching was attended by a large number of distinguished visitors. The company included Sir John and Lady Thornycroft and Mr. J. E. Thornycroft (director), Messrs. Barnaby and Donaldson (technical directors), and Rear-Admiral MacGill (Admiral-superintendent for destroyers and torpedo boats). The Board of Trade and Lloyd's were also represented. The launch was in every way successful, and after the ceremony the guests were entertained with light refreshments.

The Tartar is one of two ocean going torpedo boat destroyers ordered from the firm, and the following are the leading dimensions of hull and particulars of the machinery:—Length, 270 ft.; beam, 26 ft.; draught, 8 ft. 2 in. The vessel is fitted with turbine machinery of the Parsons' type (built by Messrs. Thornycroft) and six Thornycroft water tube boilers arranged for burning oil fuel. The contract speed is 33 knots. The armament will consist of three 12 pounder quick firing guns and two 18 in. torpedo tubes.

Lord Pirrie's election to the directorate of the London and South-Western Railway Company together with Mr. Carlisle's recent references to Southampton's facilities for building the largest vessel has led to the speculation that a shipbuilding yard is contemplated in addition to the firm's repairing shops, which are being erected here. So far no

definite pronouncement on this point has been made, but now that Lord Pirrie is on the board of the London and South-Western Railway Company he has a direct interest in Southampton's development, which augurs well for the future of the port.

Southampton's New Dock.—We understand that the London and South-Western Railway Company will shortly invite tenders for the work of constructing the large new dock here, which will be the deepest in the world, and will be capable of accommodating the largest liners building or afloat at dead low water. This great undertaking will involve the expenditure of a very large sum of money, which ought to benefit the town in general very considerably.

The Southampton Dredging Scheme.—We hear that the following firms have sent in tenders for the above work to the Southampton Harbour Board, and that the tender submitted by the Tilbury Dredging Company was recommended for acceptance. The firms tendering and the amount of the tender are as follows:—British Dredging Co., Ltd., London, total £44,332; additional 3 ft. at Thorn Knoll, giving 35 ft. L.W.O.S.T., £4087; date of completion, 31st March, 1908. T. Bevis, Portsmouth, £65,700—£24,500, 1st August, 1909. J. Best & Sons, Ltd., Edinburgh, £71,339; £20,100—31st December, 1908. Sir John Jackson, Ltd., London, £130,619—£43,000, 31st March, 1909. The Tilbury Contracting and Dredging Co., Ltd., London, £24,650—£10,500, 30th September, 1908. The committee resolved that the Tilbury Co.'s tender for dredging over the whole area to a depth of 32 ft. be accepted. The Harbour Board Engineers protecting estimate was £41,800, which worked out at 1s. per cubic yard, so that the Board are to be congratulated on having such a low tender as that of the Tilbury Contracting and Dredging Co. As will be seen from the figures given, there is an extraordinary difference in the amount of the tenders, and in view of the fact that all the firms based their estimates on the Admiralty Chart, and were well aware of the nature of the spoil they would be required to dredge, this difference is all the more remarkable.

BELFAST.

(*From our Own Correspondent.*)

At time of writing quietness reigns supreme in the ship yards and engine works, operations not having yet been resumed after the annual summer holidays.

Tonnage under Construction.—According to Lloyd's Quarterly Returns for the quarter ending 30th June, the tonnage under construction at Belfast amounted to 193,830 tons, which is an increase of 27,040 tons over the amount of work in hand at the end of the corresponding quarter of last year.

Messrs. Harland & Wolff.—On the 27th June the Queen's Island firm launched the fine twin-screw oil-tanker *Iroquois*, which they have constructed for the Anglo-American Oil Company. The new vessel is 476 ft. long by 60 ft. beam. She has been designed to carry about 10,000 tons of oil in bulk, and it is understood that this is the first oil tank steamer to be fitted with twin-screws, the machinery consisting of two sets of quadruple-expansion engines and four steel boilers.

A London correspondent has stated that the big Hamburg American liner which is being built by Messrs. Harland and Wolff will be propelled by a combination of turbine and reciprocating engines. She will have three screws, the two outer ones driven by the latter type and the centre one by the former.

Good progress has been made with the construction of the new forward length of the wrecked White Star liner *Suevic*, the framing being complete and plating started on. As this work only occupies half the length of a building slip, to save time part of the keel of another vessel has already been laid upon the upper portion of the slip.

Messrs. Workman, Clark & Co.—This firm has orders in hand sufficient to keep them in full swing for some considerable time to come. They have already got a vessel in frame on the new building slip recently constructed in their South yard. At the fitting-out wharves they have three of the new Lloyd-Braziliero vessels, namely, the *Para*, the *San Paulo* and the *Ceara*. Within the next few months several other steamers which they have under construction for this company will be put in the water.

Labour Troubles.—There appears to be no immediate prospect of a settlement of the dockers' and carters' strike, and almost the entire trade of the city is in a state of semi-stagnation, owing to the great difficulty experienced in getting goods to and from the steamers. At the time of writing last month's notes the strike was confined to the labourers employed by the Belfast Steamship Company, but now all the principal Cross-Channel shipping companies are concerned in it. To add to the difficulty, the coal merchants have locked out all their coal-dischargers and carters until such time as they agree to work amicably together—union with non-union men. The employers have been forced into taking this step owing to the continual interference with their working arrangements by trades union officials, even after they, the masters, had granted the advance in wages and altered conditions of work demanded by the society. Only three cargoes of coal have been discharged within the past two weeks, and those by the Co-operative Society, which has undertaken the supply of fuel to the working classes. On all hands the want of coal is beginning to be felt, and already two or three factories have been compelled to shut down. Some idea of the carting difficulty may be gathered from the fact that on numerous occasions carts have been stopped in the street, and, under the very eyes of the police, the goods have been tipped on to the street. Vans have been smashed, burned, or thrown into the river; and these tactics are what the strikers' pickets are pleased to term "peaceful picketing." The military have for some weeks past been stationed along the quays, but so far have not been called upon to take any active part in quelling disturbances.

At the time of writing the strike of iron-moulders also remains unsettled.

Dock Fire.—On the night of July 18th a serious fire broke out in one of the storage sheds at the York Dock. Considerable damage was done, the eastern end of the shed and its contents—for the most part flax—being completely destroyed. Fortunately, the disaster was not attended by loss of life, though the night watchman was badly burned.

JUNIOR ENGINEERS.

XI.*

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Moulding (*continued*)

It frequently happens that the number of partings required even with a small job preclude the possibility of employing moulding boxes. In this event the pattern is moulded on the floor, and the main body having been bedded down, the partings are arranged for by means of drawbacks. The drawback is a cast-iron plate provided with lifting lugs. This is set up two or three inches from the pattern, and the sand rammed up to it so that a mould is formed which can be lifted clear of the pattern; the pattern is left loose so that the portion thus parted is removed easily from the main body and can then be withdrawn from the mould. The parting is made firm with the trowel, and, if vertical, the surfaces are made sufficiently damp to enable the parting sand to adhere to them.

Although cast-iron drawback plates are necessary for heavy jobs, the lighter parts may be supported with cakes of loam, baked hard, to which the sand adheres, these loam cakes being also used for light horizontal partings to save ramming up a moulding flask for the purpose.

The illustration shows a common form of valve chest which will be moulded as in Fig. 2, the two branches being the upper side of the mould and the lines of parting along B and C.

* For Articles I. to X., see last ten issues.

The pattern is made solid, the branches screwed on and the two flanges at A loosely fixed to their respective branches with dowel pins and temporarily sprigged to keep them in position. Where, as in this case, the flanges are so close together as almost to touch, it is better to join them, for the narrow ridge of sand would otherwise be broken away by the flow of metal and form as dirt in the casting.

The body of the core being symmetrical, is made in a one-half box and the cores for the branches fixed on separately, the dividing ribs in the chest appear as wood partitions in the core box, with bosses screwed on at D for the valve seats, and having prints which leave impressions in the main core in which the circular cores for the seat are fitted.

With this form of chest the pattern can be bedded down in the floor to the parting B, an open box being used for the part between B and C, and either another box as a cope for the flanges A or merely a loam cake in order to mould a similar chest having branches on each side two drawbacks would be required, with the mould vertical in as Fig. 1, and two partings along the centre lines of the side and end branches.

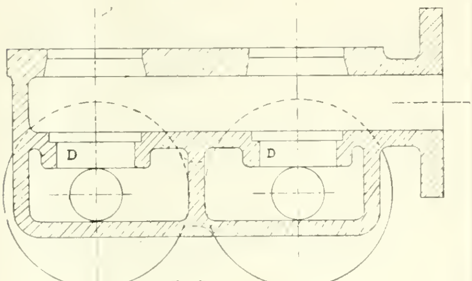


FIG. I

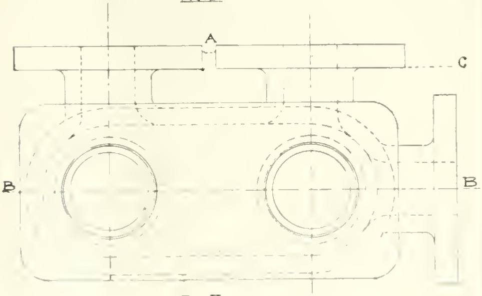


FIG. II

The floor is prepared by making a pit sufficiently deep, allowing nine or ten inches below the pattern base; broken coke or other loose material is filled in for a depth of four or five inches and then the same depth of ordinary sand is lightly rammed down and levelled; facing sand is riddled in and the pattern placed in position and stakes driven into the sand at the sides to keep it in place. The pattern, after being struck lightly, is lifted out and any projections on the under side are removed from it and bedded down flush in their impressions. The bed is vented by passing the vent wire down through the sand and the pattern then replaced, guided by the stakes, to its original position; facing sand is then rammed up round the pattern and the pit filled in with ordinary sand rammed up to the first parting along the line B.

This parting having been firmly made, it is covered with parting sand, and a moulding box placed over the pattern is staked in position and rammed up with sand to the second parting along the line C. The second parting having been prepared as before the flanges and their prints are covered over and rammed up and a loam cake placed over this and made secure, or, if a box is used as a cope, it is placed upon the lower flask and rammed. The cope is now lifted off, taking with it the flanges, which were loosely dowelled to the main pattern; the lower moulding flask is then lifted upward, care being taken not to tear the mould, and the pattern removed.

The mould is mended where broken away and sprigs used to strengthen such portions, the cores are placed in position with the necessary chaplets, all vents made as required, the parts assembled, the mould closed and the cope weighted to resist the fluid pressure.

The method of pouring is decided by the weight of the casting and the manner of moulding. A casting of this type and weighing two or three cwt. moulded thus in green sand may be run from a pouring basin in the cope to the top flanges. Heavier castings are, however, better run from below. The gate passing down from the cope to the bed is formed by ramming in tapered gate-pins while making up the mould, the gates having several runners leading to different parts of the mould to facilitate the flow of metal.

Besides the gate for the inflow of metal, a riser is formed in the cope which allows for the egress of the expelled air, acts as an overflow for the metal, and assists the removal of impure metal from the inside of the mould.

REVIEW.

The Law of Building, Engineering and Shipbuilding Contracts. By Alfred A. Hudson, Barrister-at-Law; two vols., third edition. London: Sweet & Maxwell, 1907.

The author of this standard work on the contracts relating to one of several of the most important branches of industry has had the advantage of practical experience as an architect prior to his entry into the legal profession, and thus he brings to bear on the complicated branch of law with which he deals a thorough knowledge of the practical as well as of the legal side. The form of his book is of the clearest and most modern kind, being that which has approved itself in such authoritative works as Odgers on Libel and Slander and Stephen's Digest of the Criminal Law. That is to say, each proposition, when stated, is followed by a series of illustrations taken from the Reports. And here it should be noted that not only are our own reports drawn on for authority, but that use is made of a large number of cases which have been decided in the American and Canadian Courts. These latter cases cannot, of course, be taken to be absolute precedents before an English Bench, but at the same time they will always command the respectful attention of our judges and there can be little doubt that the arguments which commended the principles on which they were decided on the other side of the Atlantic will have their weight before our own tribunals.

The distinction between what in law are known as penalties and liquidated damages is one which it is hard for a layman to appreciate. But that difficulty will be found to be largely removed by a careful study of Mr. Hudson's chapter on the subject. So, too, we may refer our readers to the chapter on the vesting of property in materials and plant—a point which sometimes becomes very important to those who have placed a contract for the building of a ship with a firm which has the misfortune to get into difficulties during the progress of the work. Thus it may be broadly stated that with regard to the unfixed materials for the construction of a vessel—in the absence of express agreement—the property remains in the shipbuilder and does not pass. But if the property in the ship passes, all articles fixed in her or in a reasonable sense made part of her *corpus* go with her, and when she is completed spare gear goes with her also. Such spare gear has been defined as everything of that character without which it would not be prudent to send her to sea.

In the second volume will be found somewhat lengthy reports on important cases, tables of scales of architects' and surveyors' charges, and a number of useful precedents including forms of invitation to tender and forms of contracts as well as a list of the more important statutes relating to buildings. The whole work is indispensable to those who are connected with building contracts, and will be of great value to engineers and shipbuilders who may not always be able to take legal advice in the time which may be at their disposal.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES English.

Eleni Stathatos.—On June 24th Messrs. R. Craggs & Sons, Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer 347 ft. long, 47 ft. beam, 23 ft. deep. This vessel is being built under special survey to take the highest class at Lloyd's, being of the single deck type, having poop, bridge and forecastle. Accommodation is provided for captain and officers in spacious deck-house on bridge, the engineers being berthed in deck-house round after end of casing, and the crew in the forecastle. Cellular double bottom is fitted throughout for water ballast, which is also carried in fore and after peak, capacity being provided for about 1150 tons of water. Six extra large steam winches are provided for the rapid loading and discharging of cargo. Large marine type donkey boiler and steam steering gear are supplied, improved quick-warping steam windlass being fitted forward. A special feature of the steamer's construction is the clear holds, the deck being supported upon girders and wide-spaced mast pillars placed well back from hatch sides, which, together with the builders' special design of framing, practically reduce obstructions in the holds to a minimum. The machinery will be fitted by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough, and will have cylinders 23 in., 39 in., 65 in. and 42 in. stroke, steam being supplied by two large single-ended boilers working at a pressure of 100 lbs. to the square inch. Messrs. S. T. Taylor and Sons have covered boilers, pipes, etc., with their "Tynos" non-conducting material. The vessel has been designed to afford a large cubic capacity, and is expected to lift about 5350 tons deadweight on a light draught. She has been, built to the order of Donys. A. Stathatos, Esq., of Athens, and on leaving the ways was named *Eleni Stathatos* by Miss May Craggs, of London. During construction the vessel has been under the superintendence of Mr. J. W. Donovan, of Snnderland.

Hessle.—On June 24th Messrs. W. Pickersgill & Sons launched from their yard at Southwick a finely-modelled steel screw steamer. Dimensions :—Length, 215 ft. ; breadth, 32 ft., and depth 15 ft. 3 in. Machinery and boilers are being supplied and fitted by Messrs. Geo. Clark, Ltd., Southwick. Messrs. S. T. Taylor & Sons have covered boilers, pipes, etc., with their "Tynos" non-conducting material. The owners are Messrs. J. H. Wetherall & Co., Goole, and during construction the vessel has been under the supervision of Mr. Thos. Wetherall. As the steamer left the ways she was gracefully named the *Hessle* by Mrs. Atkin.

Muirfield.—On June 24th a new screw steamer, named the *Muirfield*, built to the order of the Doughty Shipping Co., Ltd., West Hartlepool, was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields. The vessel is of the improved single-deck type, built to Lloyd's highest class, having large clear holds, without beams or other obstrnctions, with long bridge, poop and topgallant forecastle ; cabin houses are placed upon the bridge for captain and officers, and separate house for engineers and apprentices, the crew being berthed in topgallant forecastle. The vessel has a double bottom all fore and aft for water ballast, and after-peak is also arranged for this purpose ; she is well equipped with winches and derricks at large hatches for the rapid loading and discharging of cargo. The vessel will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, having cylinders 24 in., 40 in and 63 in. with 45 in. stroke, supplied with steam from two large steel boilers working at a pressure of 160 lbs. per square inch.

Antinoe.—On June 26th Messrs. Craig, Taylor & Co., Limited, Stockton-on-Tees, launched from their Thornaby Shipbuilding Yard a handsomely modelled steel screw steamer of the following dimensions, *viz.* : 316 ft. by 44 ft. 3 in. by 22 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's, under special survey, and is of the single-deck type with poop, long bridge and topgallant forecastle ; water ballast in double bottom fore and aft, and in peak. She is fitted with patent steam windlass, with quick-warping ends, by Messrs. Emerson, Walker & Thompson Bros., patent steam-steering gear, five large steam winches by Messrs. R. Roger & Co., Ltd., Riley's donkey boiler, Hastie's screw gear aft, telescopic masts to Manchester Ship Canal requirements, and all the latest improvements. The accommodation for captain and officers is neatly fitted up in large central deck-house with handsome saloon, and the engineers are berthed in houses at the after end of the bridge, and the crew in the forecastle. Her engines have been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, the cylinders being 22 in., 36 in., 59 in. by 39 in., with two large steel boilers working at 160 lbs. pressure of steam. The vessel, which is similar to a number the firm have already built, is for the Egypt and Levant Steamship Co., London, (Messrs. Alfred Laming & Co., London, managers), and is a duplicate of the s.s. *Antigone*, which Messrs. Craig, Taylor built for the same owners last year. The ship and engines have been built under the superintendence of Mr. W. H. Robson, of Cardiff. As the vessel left the ways she was gracefully christened the *Antinoe* by Mrs. Herbert Taylor, wife of the governing director of the shipbuilding company.

Indian Empire.—On June 25th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 135 ft. by 22 ft. 6 in. by 12 ft. 4 in. depth of hold. The vessel has been built to the order of Messrs. The Cargill Steam Trawling Co., Ltd., of Hull, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, of Hull, and is replete with all the latest improvements for fishing purposes, having whaleback forward, hood aft, etc. As the vessel left the ways she was gracefully christened the *Indian Empire* by Miss Irene Cargill, of Hessle, after which the company adjourned to the builders' offices, where cake and wine was served and the customary toasts given and responded to.

Hartington.—On June 26th Messrs. William Gray & Co., Limited, launched at West Hartlepool the handsome steel screw steamer *Hartington*, which they have built to the order of J. & C. Harrison, Ltd., London. She will take the highest class in Lloyd's and is of the following dimensions, *viz.*, length overall, 371 ft. 6 in. ; breadth, 50 ft., and depth 28 ft. 4½ in., with extra long bridge, poop and topgallant forecastle. The saloon, state rooms, captain's, officers and engineers' rooms, etc., will be fitted np in honses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep frames, clear holds, cellular double bottom and large aft and fore-peak ballast tanks, eight steam winches, return exhaust and winch condenser, steam-steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, steel shifting boards, stockless anchors, telescopic masts with fore and aft rig, boats on beams overhead and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders having cylinders 26 in., 42 in. and 70 in. dia., with a piston stroke of 45 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. The hull and machinery have been built under the snperintendence of Mr. E. J. Caiger, on behalf of the owners, and the ceremony of naming the steamer *Hartington* was gracefully performed by Miss Jeanette Harrison, London.

Tord.—On June 26th Messrs. W. Harkess & Son, Ltd., launched from their Middlesbrough yard the steel screw steamer *Tord*, which has been built to the order of Messrs. G. & L. Beijer, of Stockholm, for the timber and grain trades. The dimensions are :—242 ft. by 38 ft. by 18 ft. moulded depth. She is designed to carry 2300 tons of cargo on light draught, and will be fitted with engines 18 in., 30 in., 49 in. by 33 in., and two large boilers by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Sunderland. The christening ceremony was performed by Mrs. John Storrow, of Redcar.

Ambriz.—On June 27th Sir. Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough, a fine steel screw passenger and cargo steamer built to the order of Messrs. Empreza Nacionalde Navegacao, of Lisbon. She is built to Lloyd's 100 A1 Class, awning deck rule, her principal dimensions being 210 ft. by 30 ft. by 18 ft. moulded with a deadweight carrying capacity of about 700 tons on a light draught of water. The accommodation and saloon for

first-class passengers will be provided in shelter 'tween decks with entrance house, lounge and engineers' berths on awning deck above, while the captain and officers' cabins will be fitted up in steel house on promenade deck. The sailors and firemen will be berthed in forecastle and emigrants in 'tween decks forward. The upper deck will be of steel and main decks of pitch pine. Triple-expansion engines, placed aft will be fitted by the North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 15½ in., 25 in. and 41 in. by 27 in. stroke, supplied with steam by one large boiler working at 180 lbs. pressure. On leaving the ways she was gracefully named *Ambriz* by Mrs. T. C. Laws, wife of the owners' superintendent.

Competitor.—On June 27th, Messrs. Furness, Withy and Co., Limited, Hartlepool, launched the steel screw steamer *Competitor* which they have built to the order of Messrs. The Eskside Steam Shipping Company, Limited, Whitby (Messrs. C. Smales & Son, managing owners). The vessel exceeds 360 ft. in length, has a large measurement capacity and takes highest class in Lloyd's Register. She is built on the deep frame principle with single deck, poop, bridge and forecastle, with clear holds for the stowage of bulky cargoes. The hatches are large and are worked by six powerful steam winches, double derricks being fitted to each hatch; cellular double bottom extends all fore and aft, the fore and after peaks being available as tanks. Wood shifting boards throughout, direct steam windlass, large multitubular donkey boiler, steam and hand-steering gear, freshwater condenser, and all up-to-date auxiliaries will be included in the vessel's equipment. Accommodation for the captain and officers will be provided in large deck-houses on the bridge deck, the crew being berthed in the forecastle. The vessel will be rigged as a two-masted fore and-aft schooner. Triple-expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, with cylinders 24 in., 39 in., 66 in. by 45 in. stroke, steam being supplied by two single-ended boilers 16 ft. dia. by 10 ft. 6 in. long working pressure 180 lbs. per square inch. The vessel has been built under the personal supervision of Mr. T. Maccoy, Newcastle-on-Tyne. The vessel was gracefully christened *Competitor* by Mrs. Bruce, of Whitby (wife of J. Bruce, Esq., chairman of the Eskside Steam Shipping Co., Limited).

Ingleby.—On June 28th Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*: Length 365 ft.; breadth 50 ft.; depth, 23 ft. The vessel is built to the highest of British Corporation class, to the order of Messrs. R. Ropner and Co., West Hartlepool, and is fitted with the builders' patent improved trunk deck, with clear holds and deep frames. The saloon-house, with accommodation for captain and officers, and a house for engineers will be fitted up on the trunk deck, with the crew in topgallant forecastle and apprentices aft. The vessel has double bottom for water ballast on the cellular principle, also in the fore and after peak tanks. The deadweight carrying capacity will be about [illegible] tons on her summer freeboard. The vessel will be fully equipped with an up-to-date outfit, having a quick warping windlass, stockless anchors, steam-steering gear amidships, with powerful screw gear aft. The appliances for loading and discharging expeditiously are very complete, and include extra derrick posts and double derricks, nine steam winches, steam being supplied by a horizontal multitubular donkey boiler. The engines will be of the triple expansion type, supplied by Messrs. Blair & Co. Ltd. of about [illegible] I.H.P. steam being supplied by two large main boilers at a working pressure of [illegible] lbs. per square inch. The christening ceremony was gracefully performed by Miss Winsome Ropner daughter of Wm. Ropner, Esq., West Hartlepool, who gave the vessel the name of *Ingleby*.

Marlborough.—On June 20th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 115 ft. by [illegible] ft. [illegible] in. by [illegible] ft. 6 in. depth of hold. The vessel has been built to the order of Messrs. The Queenstown Fishing Co., Ltd. of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Marlborough* by Mrs.

J. R. Sturdy of Hull, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Palma.—On June 29th Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, launched the handsome steel screw steamer *Palma*, built to the order of Messrs. Elder, Dempster & Co., Liverpool. The *Palma* is a beautifully-modelled shelter-deck vessel and is a sister ship to the s.s. *Abonema*, recently launched by Irvine's for the same owners. The vessel is intended for service on the West Coast of Africa and is of the following dimensions, *viz.*: length, 336 ft., breadth, 46 ft. and depth, 25 ft. 3 in. moulded; classed 100 A1 at Lloyd's, having cellular double bottom fore and aft, with large after-peak tank. The vessel is divided by six transverse bulkheads into seven compartments and with three complete decks fore and aft. Every attention has been paid to appliances for rapid loading and discharging of cargo, the vessel having nine steam winches of the firm's own make and eleven derricks, one derrick of steel with fittings capable of lifting 15 tons. Accommodation is provided for the captain and chief officers, state-rooms, etc., with dining saloon in house amidships, captain's day-room, chart and wheelhouse above under the upper flying bridge. The engineers and remaining officers, with baths and w.c.s, are placed in steel houses abreast of engine and boiler casing on the shelter deck, with promenade and boat-deck overhead. The firemen, seamen, and petty officers, with their w.c.s and wash places, messrooms, etc., etc., are all placed aft under the shelter deck. A complete installation of electric light by Messrs. Campbell & Isherwood is fitted throughout the vessel, including signal lamps, binnacles and cargo clusters at each cargo hatch, as well as oil lamps for emergency purposes. Steam-steering gear is placed amidships with leads aft to quadrant led alongside of hatches, quick-warping windlass forward and large multitubular donkey boiler of ample capacity for the supply of steam to the deck machinery. Engines of the triple-expansion type are being supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 24 in., 40 in., 66 in. diameter by 45 in. stroke, steam being supplied by two extra large main boilers working at a pressure of 180 lbs. per square inch. The christening ceremony was gracefully performed by Mrs. S. W. Furness, there being also present Mr. S. W. Furness, J.P., Mr. Roxburgh (owners' superintendent), Mr. A. S. Purdon, J.P., and Mr. J. T. Harris.

Canadian.—On July 9th Messrs. William Dobson & Co. launched from their shipbuilding yard at Walker the steel screw steamer *Canadian*, which they have built to the order of Mr. J. W. Norcross for service on the great lakes of Canada. The vessel has been built to special survey under the British Corporation, and is of the following dimensions: length overall, 256 ft.; breadth, 43 ft.; depth moulded, 26 ft. The engines, which have been constructed by Messrs. The Wallsend Slipway & Engineering Co., Ltd., are placed at the after-end of the vessel, and are of the triple-expansion type with cylinders 19 in., 32 in., 52 in. by 36 in. stroke, with two boilers, 180 lbs. pressure. All the details and outfit are of special construction for the great lakes' requirements. 'Tween decks are fitted all fore and aft, with large side cargo ports, steam winches and electric light, and specially large deadweight carrying capacity has been arranged on a very light draught for passage through the Welland Canal.

Blackwood.—On July 10th the Blyth Shipbuilding Co., Ltd., launched from their shipbuilding and graving-dock works the steel screw steamer *Blackwood*, built to the order of Messrs. The Tyneside Line, Limited (Messrs. John Ridley, Son & Tully, of Newcastle managers). This vessel, which measures 244 ft. in length with a beam of 33 ft. 6 in., has been constructed under Lloyd's special survey to class 100A1. She is of the raised quarter-deck type, having short bridge and topgallant forecastle. The accommodation for captain is provided in the bridge, engineers and officers in sidehouses on raised quarter deck, and crew will be berthed in topgallant forecastle. The *Blackwood* is specially adapted for the coal and ore trade having exceptionally large self-trimming hatches, together with the best and latest design of deck machinery for the quick and economical working of the cargo, comprising four steam winches by Messrs. John Smith and Sons, steam-steering gear by Messrs. Donkin & Co., donkey

boiler by Messrs. Blake Boiler, Wagon and Engineering Co., Ltd., and windlass by Messrs. Emerson, Walker & Thompson Bros. Triple engines of good power will be supplied and fitted by Messrs. North-Eastern Marine Engineering Co., Ltd., of Sunderland. As the vessel left the ways the christening ceremony was gracefully performed by Miss Scott, daughter of J. R. Scott, Esq., Benton. The hull and machinery have been built under the supervision of Jos. R. Scott, Esq.

Newmarket.—On July 11th there was launched from the yard of Earle's Shipbuilding and Engineering Co., Ltd., Hull, the s.s. *Newmarket*, which has been built to the order of the Great Eastern Railway Co. The principal dimensions are: length, 245 ft.; breadth, 31 ft.; depth of hold, 15 ft. The vessel is a handsomely modelled steel twin-screw steamer, built under the superintendence of Captain D. Howard and Mr. J. N. Blenkinsop, and is intended for service between Harwich and Rotterdam. She is designed with a view to maintaining a good rate of speed in all weathers in order to save markets, and is specially constructed for carrying cargoes of meat and other perishable goods. The *Newmarket* has a long poop, bridge, and topgallant forecastle, and is fitted for accommodation of horses under these erections. The holds and 'tween decks are ventilated by powerful fans supplying a continuous current of air. The vessel has two masts fitted with strong derricks, three steam winches and a steam crane; these are arranged to permit rapidity in handling the cargo. She will be fitted with patent steam tiller and telemotor gear by Messrs. Brown Bros., Edinburgh, and a powerful steam windlass. The captain's cabin is situated on the bridge deck, the officers and engineers are berthed in commodious rooms amidships, and the seamen and firemen in the forecastle. The vessel will be propelled by twin-screw balanced engines, having cylinders 15½ in., 25¼ in. and 41 in. diameter respectively, with a common stroke of 36 in. The boilers are to be two in number, working with forced draught under a pressure of 180 lbs. per square inch.

Guardian.—On July 12th Messrs. Swan, Hunter & Wigham Richardson, Ltd., launched from their Neptune Yard, at Walker, the s.s. *Guardian*, a cable steamer which they are building for the Central and South American Telegraph Co., Ltd. The vessel is being built under Lloyd's Special Survey and has an overhanging bow for cable sheaves, and is a type of which the builders have had considerable experience in recent years. She is 270 ft. long by 36 ft. beam, and is constructed to carry about 700 tons of cable and a total deadweight capacity of 1,750 tons on 18 ft., having twin screw engines 15½ in., 25 in., 43 in., by 30 in., and two boilers, 13 ft. 3 in. by 11 ft. 6 in., fitted with Howden's forced draught, and will be capable of a speed of 12 knots. The special features of this vessel are the tanks for storing cable and the picking-up and paying-out machinery and bow and stern sheaves. In addition to the accommodation for the captain, officers and electricians, special apartments will also be suitably arranged for electrical experiments. The decks are of teak. A large equipment of boats has been provided, also a 28 ft. motor launch by Collis, of Southampton. The auxiliary machinery embraces steam capstan windlass and two steam winches by Clarke, Chapman & Co., steam steering gear by Alley & MacLellan, and electric light is fitted throughout. The special cable machinery is being supplied by Messrs. Johnson & Phillips, and is of a very complete and up-to-date type. Present at the launch were Mr. J. M. Robertson, Mr. Septimus Glover and Mr. Ernest Glover, representing the owners, Mr. J. S. Bonnyman, their engineer, and Captain Taylor and a large company of other ladies and gentlemen. The christening ceremony was performed by Mrs. J. M. Robertson.

Wychwood.—On July 12th Messrs. Osbourne, Graham and Co. launched from their yard at Hylton, Sunderland, the steel screw steamer *Wychwood*, which they have specially constructed for the well-known trade of Wm. France, Fenwick & Co., Ltd., of Sunderland and London; it is the fifth vessel of this type built for this firm. She is built as a self trimming collier and carries 3,100 tons on a shallow draught, and has been constructed to take Lloyd's highest class. The accommodation for the officers has been fitted up in the poop, the cabins, saloon and mess-room being tastefully fitted out in hardwood. The engineers' accommodation is fitted around the engine and boiler casing under the after end of the bridge. The vessel is equipped with the most modern appliances for economical working of cargo, the winches, steam windlass and donkey boiler all being supplied by Messrs. Clarke, Chapman & Co., Ltd., of Gateshead, and steering gear by Messrs. Donkin & Co., of Newcastle. As the vessel left the ways she was gracefully christened by Miss Browne, of Christon Bank. During construction, the hull has been under the superintendence of Messrs. Squance and Ingram, of Sunderland, and the machinery has been inspected by Messrs. Thompson & Eyres, of Sunderland. Engines are to be supplied by the North-Eastern Marine Engineering Co., Ltd., of Sunderland, and have cylinders 20½ in., 33 in., 54 in. by 39 in. stroke, with two large boilers working at a pressure of 190 lbs.

Lonhi.—On July 10th, in the presence of a large gathering, including official representatives of the Greek community in Great Britain, a torpedo-boat destroyer built for the Greek Government was launched from the yard of Messrs. Yarrow and Co., Ltd., at Poplar, and received the name of *Lonhi*. The Greek Minister, who named the boat on behalf of the King of the Hellenes, was accompanied by Mme. and Mlle. Metaxas, and the staff of the Legation. After the religious ceremony by the Rev. Great Archimandrite Pagonis, the Greek Minister made a speech suitable to the occasion, and the launching took place amid the cheers of the company. The dimensions of the boat are:—Length, 220 ft.; breadth, 20 ft. 6 in.; and depth, 12 ft. 4 in.; I.H.P., 6000; contract speed, 31 knots. The *Lonhi* is the third vessel of this class built by Messrs. Yarrow & Co., Ltd., for the Greek Government.

LAUNCHES—Scotch.

Gerd.—On June 24th there was launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, the steel screw steamer *Gerd*, the first of two sister vessels being built to the order of Wicanders Rederi Aktiebolag, Stockholm. The dimensions of the vessel are: length between perpendiculars, 285 ft.; breadth, 42 ft.; depth, 22 ft.; and the deadweight carrying capacity about 3500 tons on a light draught. Triple-expansion engines will be supplied by Messrs. David Rowan and Co. During construction the owners have been represented by Captain E. Forsberg.

Yulgilbar.—On June 26th Messrs. Ailsa Shipbuilding Co., Ltd., Troon, successfully launched from their yard the twin-screw steamer *Yulgilbar*, 800 tons register, built to the order of North Coast Steam Navigation Company, Limited, Sydney, for their cargo and passenger trade. The vessel has been built to special class in British Corporation and fitted with all the latest appliances for rapid handling of cargo, under the superintendence of Mr. Charles M'Allister, Sydney, by whom she was designed. The builders will furnish two sets of triple-expansion engines of 1200 indicated horse power. The naming ceremony was gracefully performed by Miss Alice M'Allister, Sydney. After the launch, a numerous company of ladies and gentlemen, presided over by the Marquess of Ailsa, partook of luncheon in the Marine Hotel, on the invitation of the builders. Messrs. Paton & Hendry, 142, St. Vincent Street, are the Glasgow agents for the North Coast Steam Navigation Co., Ltd.

Onda.—On July 3rd there was launched from the Castle Works of the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, for Navigazione Libera Triestina Societe in Azioni, of Trieste, a steel cargo steamer, 315 ft. by 46 ft. 6 in. by 23 ft. 4 in. The vessel was named *Onda*, and immediately after the launch was placed under the crane in the builders' dock to receive her engines and boilers, which have also been constructed by the builders.

Celtic King.—On July 6th Messrs. Archd. McMillan & Son, Ltd., Dockyard, Dumbarton, launched the steel screw steamer, *Celtic King*, which they have built to the order of Messrs. R. Hughes-Jones & Co., Liverpool. The principal dimensions are: length, 395 ft.; breadth, 51 ft. 3 in.; depth moulded, 27 ft. 3 in. and the vessel is built on fine lines, and is of the single-deck type with complete shelter deck, but with lower deck fitted in forward and aft holds only; thus, in addition to carrying a large deadweight, the vessel has also very large cubic capacity. She has also been specially designed to enable large pieces of machinery, etc., to be shipped with little trouble, the hatches being exceptionally large, and the holds being kept clear of obstruction for this

purpose. Accommodation for captain, officers and engineers is provided on top of shelter deck amidships, while the poop is fitted up for a native crew. The vessel has a complete installation of electric light. There are ten powerful steam winches driven by a large donkey boiler, and a large number of derricks are also fitted, thus ensuring the rapid handling of cargo. The machinery is being supplied by Messrs. Dunsmuir & Jackson, of Glasgow, having cylinders 26 in., 43 in., and 72 in. by 48 in. stroke, two single-ended boilers, 16 ft. 3 in. by 12 ft., 180 lbs. pressure, Howden's forced draught, and in all respects the vessel is fitted out in a very superior manner for a cargo boat. Messrs. Wailes, Dove & Co.'s bitumastic enamel was applied in lower bunkers, and their bitumastic covering to tank top in boiler-room. The christening ceremony was performed by Mrs. John Needham, Dumbarton. The vessel and her machinery have been built under the superintendence of Messrs. E. H. Bushell, Fletcher and King, Liverpool.

California.—The Anchor Line Steamship Company, who have for nearly fifty years carried on between Glasgow and New York a regular line of passenger steamers, have added to their fleet during the last few years the steel twin screw passenger steamers *Columbia* and *Caledonia*, which have been such a great success in every way, and commanded such a large share of patronage of the travelling public, that the directors of the company have now built another vessel of the same class, named the *California*, which was launched at Meadowside, Partick, on July 9th, the christening ceremony being performed by Lady Ure Primrose, and the vessel will be all ready and fully equipped in every particular to take her place in the regular service of the company in good time for the autumn and winter season of 1907. The new steamer is 485 ft. in length over all by 58 ft. moulded breadth and 38 ft. 6 in. deep to the tonnage deck, with a gross tonnage of 9,000 tons, and, when fully loaded, her displacement will be not less than 15,000 tons. Speaking generally, the *California* is a strikingly handsome and imposing-looking vessel, with a straight stem and elliptical stern, having two steel pole masts of fore-and-aft schooner rig, and two tall funnels. There is a spacious bridge-house, an extra long poop-house, and a commodious forecastle. The vessel is divided up, so as to ensure her safety, into nine watertight compartments, and for the purpose of administration and to secure the comfort of passengers and the rapid handling of cargo the accommodation on board is distributed throughout six decks. The first-class accommodation is situated amidships, with state-rooms for 250 passengers on the promenade, bridge and main decks. The state-rooms on the promenade deck for one, two or three passengers are a special feature in this vessel. They are very luxuriously fitted up, and have large square windows fitted with ornamental shutters and a handy screw ventilator, which can be adjusted at will. The rooms on the bridge and main decks are equally luxurious. The main saloon is a very handsome apartment, situated on the upper deck, well lit, well ventilated, and heated throughout by copper pipes in massive marble-topped radiators. The scheme of decoration is in light Austrian oak, with a frieze of plaster work. Immediately above the main saloon on the bridge deck, and easy of access by the grand staircase, is the library, a spacious and well-appointed room, 30 ft. by 40 ft. The walls are lined with two shades of Spanish mahogany, the darker shade forming the dado, window frames and doors. Large square windows are fitted with stained glass draw panels and sun blinds, also with easily regulated ventilators. The main staircase extending to the four decks, is carried out in light oak with teakwood banisters and rails, and the vestibules are decorated throughout in panelled teakwood. On the promenade deck is fitted the smoking-room, panelled in fumed oak, very pleasing in appearance. The dado is slightly darker than the upper panels, and at the after end of the room is placed the bar, which is of elaborate design and a distinct decorative feature of the apartment. Comfortable lounge seats are fitted all round, upholstered in morocco leather, with seat ends and elbows to match the rest of the decorations. The whole of the accommodation here as elsewhere is arranged so that the maximum of comfort will be within easy reach of every passenger. The second-class accommodation is also fitted amidships towards the after end of the vessel, with state-rooms on the upper and main decks for about 400 passengers, who will find that their comfort and convenience in every respect have been exceptionally well provided for. The dining saloon on the upper deck is lined with solid mahogany, painted enamel white, with polished mahogany pilasters. The furniture is of oak, and much superior in design and finish to what is usual in second cabin accommodation. The ladies' room or library is directly above the saloon, and is also finished in mahogany painted enamel white, with oak furniture. On the promenade deck there is a spacious and well-appointed smoking-room. In the first and second-class accommodation the stairways, corridors, saloon entrances and other places where there is most traffic are floored with patent rubber tiles, which render it impossible to slip, even in the roughest weather, and add much to the quiet and comfort of passengers. A very thorough and complete system of natural and mechanical ventilation has been fitted throughout the entire vessel, and electric fans have been placed wherever they are required. The captain and officers have been berthed all together in adjoining rooms on the boat deck, altogether apart from the passengers, but adjacent to the navigation bridge. Special attention has been devoted in the *California* to the third-class passenger accommodation, which is situated on the main and 'tween decks for 600 persons. The married people, families and single women are berthed in separate cabins on the main deck and after 'tween decks. Separate rooms are also provided for single men, and they are likewise quartered in open apartments. Ample dining accommodation is provided for the third-class passengers in a spacious saloon aft, which extends from one side of the vessel to the other, with large sidelights, affording excellent light and ventilation. Separate revolving chairs are provided for each passenger. Arrangements have been made for those passengers in the other steerage compartments who wish to dine by themselves, tables with comfortable settees being permanent fixtures. There are large wash-houses on the upper deck, two forward and two aft, for the use of male and female steerage passengers. On the upper deck aft a roomy, comfortable sitting-room, 30 ft. by 12 ft., is provided for women and children, and a commodious smoking-room, 30 ft. by 15 ft. for the men, whilst well-lit and airy covered corridors, 200 ft. in length, lead from the forward to the after end of the vessel, which provide an excellent shelter for third-class passengers, and are indeed one of the features of the vessel. A large cold storage chamber, with separate accommodation for fish, vegetables, fruit, and meat, has been placed in a convenient situation, and powerful refrigerating machinery is provided. The *California* is propelled by two sets of powerful triple-expansion engines of the latest type, supplied by the builders, with cylinders of $27\frac{1}{2}$ in., 46 in. and 75 in. diameter respectively, by 4 ft. 6 in. stroke. There are four double-ended boilers and one single-ended boiler. The steam-steering gear is of Messrs. Wilson & Pirrie's special design, fitted with spring buffers to avoid jarring and straining in heavy weather. Messrs. Hastie's patent friction rudder brake will also be supplied. On the forecastlehead there is placed a direct steam capstan windlass, fitted with warping ends, brake stoppers, etc. The *California* is not only a passenger vessel, but will be able to carry a large cargo as well, so she is provided with specially large hatches, which are required for the bulky electrical and other machinery, rails, ironwork, etc., which is now exported from America to Britain. The cargo will be loaded and discharged by means of ten horizontal winches. The *California* is intended to sail from Glasgow every four weeks, a plan which has been found to answer exceedingly well in the case of her popular sister ships, the *Columbia* and *Caledonia*.

Fedelicia Guillermina.—On July 17th Messrs. Bow, McLachlan & Co., Paisley, launched at high water a powerful tug, 55 ft. by 15 ft. by 6 ft. which they have built for Valparaiso to the order of Messrs. Wallace & Co. naval architects, consulting engineers and surveyors, London and Glasgow. On leaving the ways she was christened *Fedelicia Guillermina* by Miss Lina Wallace of London.

LAUNCH Irish.

Iroquois.—On June 27th Messrs. Harland & Wolff, Ltd., Belfast launched the fine large steel twin screw steamer *Iroquois* for the Anglo-American Oil Co., Ltd. The new vessel is 476 feet long by 60 feet beam and about 9,000 tons register, and has been specially designed and constructed for

the transport of about 10,000 tons of oil in bulk. The vessel will have an exceptionally complete oil-pumping system for loading and discharging, and all the latest and best arrangements for a vessel of this class. The machinery will consist of two sets of quadruple-expansion engines and four steel boilers, also constructed by the firm and specially arranged for the consumption of oil fuel. We understand this is the first oil-tank steamer fitted with twin screws. As the vessel left the ways she was gracefully christened by Mrs. Powell wife of Mr. F. E. Powell, one of the directors of the company who was also present at the launch, together with Mr. Archibald Maclean, manager of the Anglo-American Oil Company's Shipping Department, Mr. Ross, the company's Belfast representative, and a large number of guests. The ship during construction has been under the supervision of Mr. John Morton.

TRIAL TRIPS.

Fram.—On June 19th the fine new steel screw steamer *Fram* (of which we gave particulars in our July issue, page 459), built by Messrs. The Tyne Iron Shipbuilding Co., Ltd., to the order of Herr H. H. Wrangell, of Haugesund, Norway, left the Tyne for her official trial trip. The vessel's performance on the trial run was very creditable, a mean speed of over 10 knots being obtained, which was considered very satisfactory by all those concerned. Amongst those present at the trial were Capt. Hansen, representing the owners, Mr. J. Houston, of Sunderland, under whose supervision both hull and machinery have been constructed, Mr. G. F. Mulherion, representing the shipbuilders and Mr. J. Daglish, the engine builders.

Whitewood.—On June 22nd the steel screw steamer *Whitewood* (of which we gave particulars in our June issue, page 423), built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of Messrs. Jno. Ridley, Son & Tully, of Newcastle, was taken to sea for her trial trip, which proved highly satisfactory. During the whole of the run everything worked with the greatest smoothness, when a speed of about 11 knots was maintained on the run from Hartlepool Heugh to Whitley Bay. The managing owner, Mr. Tully, and Mr. Joseph L. Scott, of Newcastle (the superintending engineer), both expressed themselves as being highly pleased with the ship and engines. After the trial trip the vessel proceeded to the Tyne under command of Captain Robson. The vessel has a Cochran donkey boiler fitted with patent seamless furnace.

Thornley.—On June 26th the screw steamer *Thornley*, built by the Blyth Shipbuilding Co., Ltd., to the order of Messrs. Furness, Withy & Co., Ltd., was taken to sea for trial. This vessel, which measures 235 feet in length, with a beam of 36 ft., is a raised quarter-deck steamer, and has been constructed to British Corporation Class B.S. She has been fitted with extra large self-trimming hatchways, together with powerful deck machinery of the most modern type (comprising Lynns' steam winches, Cochran donkey boiler fitted with patent seamless furnace, and windlass by Emerson, Walker, etc., etc.), for the quick and economical working of vessel and cargo. Triple expansion engines of ample power have been fitted by Messrs. Richardsons Westgarth & Co., Ltd., of Sunderland—cylinders 19 in., 31 in. and 51 in. by 36 in. stroke with two single-ended boilers working at 180 lbs. pressure. S. T. Taylor & Sons have covered boilers, pipes, etc. with their "Tynos" non conducting material. A large company were on board, and on the run over the measured mile a highly satisfactory speed was made, the engines working smoothly throughout.

Tosno.—On June 26th the new Wilson liner *Tosno* (of which we gave particulars in our July issue, page 458), built by Earle's shipyard at Hull a fortnight ago, was taken on her trial trip. The vessel left the Hull Pier shortly after nine o'clock and steamed down the river, round Spurn Head and went through a set of full-speed trials over the measured mile off Withernsea. These resulted in a mean speed of 13¾ knots. The vessel's steering qualities were thoroughly tested by helm movements of full circles, both port and starboard, and these were entirely satisfactory.

Frixos.—On June 27th the handsome steel screw steamer *Frixos* (of which we gave particulars in our July issue, page 458) built by Messrs. Wm. Gray & Co., Ltd., West Hartlepool, for Mr. A. A. Embiricos, of London, was taken to sea for her trial trip. The vessel averaged a speed of 12 knots on the run round from Hartlepool to the Tyne light-ship, the performance of ship and machinery being in every way satisfactory.

Fitzpatrick.—On June 28th the large steel screw steamer *Fitzpatrick* (of which we gave particulars in our July issue, page 457), built by Messrs. R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough, for Messrs. Burrell & Son, of Glasgow, proceeded to sea for her official trials. The results were pronounced entirely satisfactory to all concerned, the vessel registering an average speed of 13 knots twice over a four-mile course.

Ivar.—On June 28th this vessel (of which we gave particulars in our July issue, page 457) had her trial trip. She has been built by Messrs. Wm. Gray & Co., Ltd., to the order of Mr. L. H. Carl, of Copenhagen. Amongst those on board were Mr. A. B. Kaempe, the owner's superintendent; Mr. Peter Bahnsen, consulting engineer, West Hartlepool; and Mr. Maurice S. Gibb, representing the builders. A very satisfactory run was made to Sunderland, the vessel's loading port, the average speed of ship being 12 knots. The vessel has a Cochran (Annan) donkey boiler with patent seamless furnace.

Abonema.—On July 3rd the new steel screw steamer *Abonema* (of which we gave particulars in our July issue, page 457), built by Irvine's Shipbuilding and Dry Dock Co., Ltd., for Messrs. Elder Dempster & Co., Liverpool, proceeded to sea on her trial trip. After adjusting the compasses the engines were put full speed ahead, and the vessel proceeded to steam between the Hartlepool and Sunderland lights, and after an excellent run it was ascertained that a speed of 12½ knots had been attained. The engines worked smoothly and the vessel gave every satisfaction. Mr. W. L. Roxburgh was present representing the owners Mr. V. Harrison, the engine builders, and Mr. A. S. Purdon, the shipbuilders. Messrs. S. T. Taylor & Sons have covered boilers, pipes, etc., with their "Tynos" non-conducting material.

Ceara.—On July 6th this new steamer (of which we gave particulars in our April issue page 354), the first of nine vessels being built by Messrs. Workman, Clark & Co., Ltd., for the fleet of the Lloyd Brazileiro of Rio de Janeiro, left Belfast Harbour, and after adjustment of compasses in the Carrickfergus Roads proceeded to the Clyde to undergo her speed trials. A company of guests representing the owners and builders were on board the vessel during the cruise. The results of the several runs over the measured mile course were of the most satisfactory nature the speed attained being 14½ knots, which is considerably in excess of the guaranteed speed, while the behaviour of the vessel under all conditions gave the utmost satisfaction. The vessel will leave for Rio in the course of a few days.

Para.—On July 8th the twin-screw steamer *Para* (of which we gave particulars in our June issue, page 425), built by Messrs. Workman, Clark & Co., for the Lloyd Brazileiro, proceeded down Belfast Lough to undergo her speed in loaded condition. The *Para* is the second steamer completed of the programme contracted for by the owners with Messrs. Workman & Clark. She is a sister ship to the *Ceara*, which is reported in this issue as having finished her trials satisfactorily. The usual stoppage was made for adjustment of compasses, after which the *Para* steamed her runs on the measured mile, averaging well over the speed required and proving to be quite as clean a ship as the *Ceara*. Trials were also made of the auxiliary and deck machinery, including the hydraulic cranes, windlass electric and refrigerating plants, and the various pumps and feeders, these tests turning out to the utmost satisfaction of all parties concerned. During the afternoon a new measured mile was sighted and arranged off the Antrim coast. The harbour master (Captain Molyneux) being on board, expressed his approval of the new course, which, being in deep water, can be used by steamers of maximum dimensions. When the Lough was reached on the return journey the steamer was manœuvred to test the efficiency of the steering gear and the anchors were let go. These, the final trials, were completed

without a hitch, and proved conclusively that the owners have a well-found as well as a handsome ship. The builders were represented on board by Mr. George Clark, D.L., M.P., Mr. Charles E. Allan and Mr. John Connel, and the owners by Captain Rosauro de Almeida, engineer commander of the Brazilian Navy; Captain Pacheco, commandant of the Brazilian Navy; and Mr. George White. When the *Para* reached the harbour she moored alongside the S. *Paulo*, at present fitting out for the Lloyd Brazileiro. The *Para* will now complete her stores and outfit, and will sail for Rio de Janeiro at an early date.

Whakarua.—On July 10th this new steamer (of which we gave particulars in our July issue, page 461) left Messrs. Workman, Clark & Co.'s wharf, Spencer Basin, Belfast, and proceeded down the Lough for adjustment of compasses and speed trials. A party representing the owners and builders were on board the vessel during the cruise, which was of the most satisfactory character, the average speed of the vessel being over the contract requirements. After the cruise the *Whakarua* proceeded to Barry for coal, after receiving which the new vessel will go on to London to take in cargo for her first voyage to New Zealand. Messrs. S. T. Taylor & Sons have covered boiler bottoms with their "Tynos" patent removable asbestos mattresses.

Acre.—On July 3rd the handsomely-modelled steel screw passenger and cargo steamer *Acre*, built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of the Lloyd Brazileiro, of Rio de Janeiro and London, proceeded to sea for her trial trip, which proved highly satisfactory. The outline particulars of the vessel are as follows: dimensions, 311 ft. by 40 ft. 4 in. by 27 ft. 6 in.; moulded to awning deck, 19 ft. 1 in., to main deck, by 12 ft. 1 in. to lower deck. The passenger decks are all sheathed, the upper being sheathed with teak; the promenade deck extends for about half the length of the vessel over the awning deck, and the boat deck is fitted over same, whilst the navigating bridge is carried above this. She has been handsomely fitted up with passenger accommodation for 90 first-class passengers in roomy berths, specially arranged to give good light and ventilation and has Hoskin's berths throughout. The saloon is in the main 'tween decks, and has been very neatly fitted up with handsome polished framing, suitable for the hot climate in which the vessel is intended to trade, with handsome well over same, showing music room above, which has also been very neatly fitted up with handsome piano, upholstered seats, parquet flooring, and special entrance hall. The smoke-room with bar and separate lavatory has been neatly fitted up at the after end of the promenade deck with every modern convenience. The captain has a suite of rooms, consisting of bed room, sitting-room, bath-room and lavatory, on the promenade deck, whilst the wheelhouse and charthouse are fitted above this on the boat deck. The engineers, officers, doctor, etc., are in berths on the awning deck. A complete installation of electric light has been fitted up throughout the vessel by the Sunderland Forge & Engineering Co., consisting of two sets of generating plant by the British Thomson-Houston Company and Peter Brotherhood, so that one set is always in reserve. The electric fittings are of a specially neat design and lend a very attractive addition to the various compartments, especially the saloon, etc. Electric fans, up-cast, etc., have been fitted in the saloon to assist in the ventilation, whilst Stone's special ventilating sidelights of large diameter have also been fitted, which will enable the vessel to have fresh air, even although these are closed in bad weather. Each of the state-rooms has a separate electric fan, so that with the large ventilators which have been provided there is ample ventilation for the hot climate, whilst for the cold climate there is a complete installation of steam heating throughout the whole of the vessel, including the crew and the third class quarters. There is also a complete installation of electric bells through the ship. The galley and pantry are fitted aft of the accommodation, and are of commodious size, the floors being neatly tiled. The cooking arrangements of the galley and pantry have been supplied by Messrs. Murray, McVinnie & Co., of Glasgow, and in addition to the two large ranges for first and third class, contains a special baker's oven, soup boilers, bain marie, hot press, whilst adjoining the galley is the baker's shop, which contains an electric dough mixer. A lift from the galley conveys food into the pantry, which is fitted up with all the usual fittings for a pantry, and in addition contains automatic egg boiler, coffee boiler, large hot press, electric knife cleaner and special refuse shoot overboard. The vessel has been fitted up with Hoskin's patent portable beds for third-class passengers in the after 'tween decks, male and female, with separate hospitals, and the usual lavatory accommodation. The lower 'tween deck is also covered with Litosilo, so as to enable the vessel to take special cargoes. Refrigerating plant has been fitted on the $C.O_2$ principle by Messrs. J. & E. Hall, Ltd., Dartford, and spaces have been specially insulated for cargo, fish, vegetables, etc. Provision against fire has been very carefully gone into, and Clayton's fire-extinguishing and disinfecting machinery has been supplied, with pipes leading to every compartment. Also further provision has been made by water service pumped up from the engine-room in addition to the usual water buckets, and patent liquid fire extinguishers to pass American law requirements. The first-class lavatories for ladies and gentlemen are neatly tiled out and are fitted with handsome St. Anne's marble basins and specially neat baths, with showers, hot and cold, whilst the gentlemen's have automatic marble urinals, all supplied by Messrs. Doulton, London. The electro-plate fittings are also very handsome. Lifeboats have been supplied for taking all the passengers on board, and have been fitted with yellow metal air tanks, and the various gear to pass the Board of Trade and American Law, including Welin's davits. Hastie's steering gear is fitted up in house aft on the Wilson-Pirrie principle, and is worked by telemotor from the bridge amidships fitted by Messrs. McTaggart, Scott & Co. In addition, the vessel is also equipped with six steam winches, steam windlass, large multitubular donkey boiler, steam capstan, also double derricks throughout, and special gear for rapid loading and discharging. The engines have been supplied by Messrs. Blair & Co., Ltd., Stockton-on-Tees, the cylinders being 25 in., 42 in., 68 in. by 45 in.; two large steel boilers working at 180 lbs. pressure, to enable the vessel to have ample steaming capacity with only moderate coal in the hot climate in which she is trading, Howden's forced draught has been fitted. The engine-room also has had special attention for easiness in working, and is fitted with separate centrifugal circulating pump, Weir's feed pumps with automatic control tank, sanitary pumps, special donkey pumps, feed heater and evaporator, See's ash ejector, whilst the propeller has been fitted with manganese bronze blades with spare bronze blades. During the whole of the run everything worked with the greatest smoothness, and over a series of runs, both with and against the tide, a mean speed of over 13 knots was obtained, this being over one knot in excess of the guaranteed speed. The owners were represented by Captain A. Rosauro de Almeida, who expressed himself as being highly pleased with both the ship and engines. The vessel has been built under the superintendence of Commodore J. C. de Carvalho, Captain A. Rosauro de Almeida, assisted by Mr. H. Hudson, M.I.N.A., and Captain Willington.

Tabaristan.—On July 12th the steamer *Tabaristan* (of which we gave particulars in our July issue, page 460), built by Messrs. David & William Henderson & Co., Ltd., Partick, Glasgow, to the order of Messrs. Frank C. Strick & Co., Ltd., London, underwent successful trials on the Firth of Clyde. During a full day's trial everything worked well and to the entire satisfaction of owners' representative. The hull and machinery have been constructed under the supervision of Mr. Archd. Walker, the owners' superintendent, assisted by Mr. Matthews.

Arizona.—On July 10th the s.s. *Arizona* (of which we gave particulars in our July issue, page 459), the third sister ship built by Messrs. Robert Thompson & Sons, Ltd., Southwick Yard, Sunderland, for Messrs. B. C. Atkinson & Son, of Middlesbrough, proceeded to sea for her official trial. A speed of over 10 knots was easily attained, and both Mr. Edward A. Atkinson and Mr. Summers, the superintendent, expressed themselves highly satisfied with the vessel and smooth working of the engines.

Eleni Stathatos.—On July 10th the steel single-deck steamer *Eleni Stathatos*, of about 5,300 tons deadweight capacity on a specially light draught, built by Messrs. R. Craggs

and Sons, Ltd , Tees Dockyard, Middlesbrough, for Denys A. Stathatos, Esq., of Athens, proceeded to sea for her official trials. The results were pronounced entirely satisfactory, the vessel registering an average speed of 13 knots in ballast trim on a 10-knot course. The machinery has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough, having cylinders 23 in., 39 in., 65 in. by 42 in. stroke, steam being supplied by two large single-ended boilers working at a pressure of 180 lbs. to the square inch. The vessel has been built to the owner's special specifications under the superintendence of Mr. J. W. Donovan, of Sunderland. A special feature of the steamer's construction is the clear holds, the deck being supported upon girders and wide-spaced mast pillars placed well back from hatch sides, which together with the builders' special design of framing, practically reduce obstructions in the holds to a minimum. The water-ballast arrangements which provide for a maximum of nearly 1150 tons, the loading and discharging facilities, also the saloon and cabins have received special attention and are of a very complete description. At the conclusion of the trip the vessel proceeded to Tyne Dock to take her bunkers.

Cardigan.—On July 17th the s.s. *Cardigan* (of which we gave particulars in our July issue, page 457), built by Messrs. Ropner & Son, of Stockton-on-Tees, made her official trial trip in the Tees Bay. The steamer has been built to the order of Messrs. Jenkins Brothers, of Cardiff, and is fitted with the builders' patent improved trunk deck. After a very satisfactory trial trip, during which a speed of over 11 knots was attained, the steamer proceeded on her run round to Cardiff under the command of Captain Davies. The owners were represented by Captain David Jenkins, of Cardiff, who expressed himself as highly satisfied with the vessel, the builders by Mr. J. R. Garthwaite and the engineers by Mr. Brotherston.

Anna.—Mr. Edward Hayes, Stony Stratford, has lately completed the steam-towing launch *Anna* for the Persian date trade, 60 ft. by 11 ft. wide, 4 ft. draught, fitted with Hayes' standard compound surface condensing engines, having cylinders 8 and 16 inches by 10 in. stroke, and a large marine return-tube boiler, built under Lloyd's survey for 120 lbs. working pressure, the whole of the machinery being specially designed for working under natural draught in the intense heat of Persia. There is a large cabin under deck forward, with sleeping bunk seats, cupboards, etc., and the top of this is specially arranged for mattresses fastened on for Europeans to rest on, with double canvas all round having large air spaces between. There is another cabin aft for crew. She ran her trials with very satisfactory results, her specified speed being easily exceeded, the mean of four runs with and against the tide being 12½ miles per hour. The engines ran very smoothly and with little vibration; she showed herself to be very easily handled and travels very cleanly. This was especially noticed by the captain of one of the London and County Council express boats who saw her running her trials. There were present at the trial H. P. Chalk, Esq., representing the Hills Bros. Co., of Bussorah, Mr. Hey, of Messrs. Strick and Co., Mr. Hartley, of Messrs. Lachlan & Co., and Mr. Edward Hayes, C.E., the designer and builder.

Morawitz.—This vessel (of which we gave particulars in our July issue, page 459), built by Messrs. Joseph L. Thompson & Sons, Ltd., of the North Sands Shipbuilding Yard, Sunderland, to the order of Messrs. The "Atlantica" Sea Navigation Co., Ltd., of London and Budapest, and is the second vessel the builders have constructed for this firm. The vessel has been constructed to meet the owners' special general and timber trades, and has been designed to have a large deadweight cargo capacity and cubical measurement space, on a moderate draught of water, to suit the Danube and other ports. A very successful trial has lately been made in the North Sea, the speed and running of machinery giving complete satisfaction to the owners' representative, who was on board. The machinery has been constructed by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, and the electric-light installation by Messrs. the Sunderland Forge and Engineering Co., Ltd., of Pallion Sunderland. The construction of the hull and machinery has been under the supervision of Mr. D. M. Robson, the company's superintendent. Messrs. S. T. Taylor & Sons have covered the boiler bottoms with their "Tynos" asbestos mattresses.

PARAGRAPHS.

The Junior Institution of Engineers.—We have been informed that M. Gustave Canet has been elected president of this ever-advancing Institution for the ensuing session, in succession to Mr. William B. Bryan, Chief Engineer to the Metropolitan Water Board, and that he will deliver his Presidential Address on Monday, 18th November next, taking for his subject "The latest improvements in English and French modern artillery."

Lord Pirrie has on several occasions taken the opportunity of bringing before the country the necessity of improving the entrances to our leading seaports and of providing dry-dock accommodation to meet the ever-increasing dimensions of steamers. His recent paper on the subject ought to be the means of not only directing the special attention of Harbour Boards and River Commissioners to the position of things as they exist, and as they ought to be, but of rousing them to action. There are many vexations in connection with the Port of London, the docks and the entrances, which in the interests of all concerned ought to be removed and dealt with on broad lines and statesmanlike principles. The conflicting interests and the small views ought to give place to a generous policy all round, which would tend to the general good; the small ideas of grabbing at sixpence more often result in losing a shilling to secure it.

Secret Commissions and Bribery Prevention.—At a meeting of the Council of the Secret Commissions and Bribery Prevention League, held on July 2nd, at the London Chamber of Commerce, Sir Edward Fry was elected as first president, and the Archbishop of Canterbury, Earl Fortescue, Lord Avebury, Sir W. H. Holland, Sir W. Mather and Mr. David Howard were elected vice-presidents. Mr. David Howard, who presided, was able to report that the League had made considerable progress, and was obtaining an increasingly influential membership. Mr. R. M. Leonard having been recently appointed secretary, the offices of the League have been removed now to 3, Oxford Court, Cannon Street, London, E.C.

Sanitary Congress.—The use of disinfectants and the abuse of the term as an expression used to describe certain substances manufactured for sale as such, formed the subject of a valuable discussion at the Sanitary Congress, held in Dublin. A paper entitled "Disinfection, considered from a medical chemical and bacteriological standpoint," was read by Mr. S. Rideal, D.Sc., in the course of which the author stated that a more advanced knowledge on the part of the public had enabled people to realize that the destruction of a bad odour or the absence of smell did not necessarily involve disinfection. There were good disinfectants in the hands of sanitary authorities, better indeed than carbolic acid, on which great reliance had formerly been placed. In the course of the discussion several speakers endorsed the view that steps should be taken to standardize disinfectants and give an opportunity to the public to know the difference between a reliable one and a useless substance called a disinfectant. The real question at issue is a very old one, and resolves itself into "What is truth?" The necessity for standardizing appears obvious from the discussion, and it is to be hoped the Sanitary Institute will take the subject up; it is of importance both ashore and afloat.

Technical Education.—The Lord Mayor of Dublin, in welcoming a congress held in the city during the closing days of June on Technical Education, spoke well on the subject, and urged full consideration and instant action in the direction of giving every facility to the growing generations and every encouragement towards technical instruction in the handicrafts, by which they could obtain a livelihood, so that the coming men of Ireland might obtain a place in the industries of the nation higher and better than their forefathers. At a subsequent meeting of the congress Mr. T. P. Gill gave an excellent address, in the opening words of which he referred to the improvement visible year by year in the deliberations of the congress, and in the general and technical education of the country. He exhorted the members of the congress to strike the note of hope and satisfaction, to sink self and self-seeking for the higher and nobler sentiments which sought the greatest good. It was wonderful what a lot of good might be done in the world, and how easily it might be done if people did not mind who got the credit.

Ireland as a health resort was referred to in a paper read by Sir John W. Moore in Dublin, and if the suggestions conveyed were more fully adopted and taken advantage of, such would no doubt tend to a better fusion of thought and of race throughout the United Kingdom. The author gave notes of the mean temperatures, rainfall and other particulars of the different districts, pointing out the advantages of each for those in search of health, restoration or holiday rest. The visit of the King and Queen in July may emphasise the suggestions made. The excellent hospitality enjoyed by the members of the Congress show that the Irish nature is warmly sympathetic, and it added to the pleasant memories of the visitors that the Countess of Aberdeen was sufficiently recovered from illness before the close of the proceedings to join the Earl in welcoming the members and delegates at a garden party at the Vice-Regal Lodge. The Lord Mayor of Dublin also held a reception, after which a most enjoyable smoking concert was given.

Thorn's School of Marine Engineering.—At the examination held at North Shields, on July 9th, 10th and 11th, Mr. J. T. Binder, of Barrow, and Mr. J. T. Cass, of South Shields, obtained their certificates as extra first-class Engineers.

At the examination held in June at the Board of Trade Head Offices, London, for the appointment of two Surveyors, one of the successful applicants was prepared at this school and passed the first time of sitting. The two latter pupils were prepared by the method of tuition by correspondence introduced by Mr. W. H. Thorn in 1880. During the last five years 68 extra chiefs have passed from the establishment of W. H. Thorn & Son, 5, Waterville Terrace, North Shields, out of whom 33 were prepared by correspondence, and of these, 28 succeeded at the first attempt, showing the efficiency of this system as conducted by these teachers. Total results from this school: 154 Extra Firsts, 29 Surveyors, and over 6800 ordinary Engineering certificates.

BOARD OF TRADE EXAMINATIONS.

NOTE 1C denotes First Class; 2C Second Class.

June 22nd, 1907.

Alexander, A .. 2C N Shields
Allman, R A .. 2C London
Anderson, W. F. 1C Leith
Ball, Rich H .. 2C Liverpool
Bavidge, S G 1C N Shields
Bell, James A 1C Liverpool
Binney, Fred M 2C London
Blaker, Fred D 1C London
Brown, Oswin 2C N Shields
Budden, Fred J 1C South'ton
Buttrum, F E 2C London
Carter, John G 2C W Hart'l
Catterson, C C 2C Cardiff
Chalmers, A .. 1C Leith
Colley, H J .. 2C London
Davies, Geo H 2C Liverpool
Dobbie, Geo D. 1C Glasgow
Douglas, W A R 1C Glasgow
Drew, Fredk .. 2C W Hart'l
Easton, William 1C Glasgow
Elson, Herbt E 1C Cardiff
Evans, Evan T 2C N Shields
Fletcher F F 1C W Hart'l
Fortune W W 2C Glasgow
Gledhill, S F 1C Liverpool
Goss, Wm ... 1C W Hart'l
Gray, John ... 2C W Hart'l
Greenwell J W 2C N Shields
Hayes, R S 1C Cardiff
Harrison H C 2C N Shields
Herbert W J 1C Cardiff
Holme D W 2C Liverpool
Horn Robert .. 1C N Shields
Hughes, W A 2C Cardiff
Hynd, David .. 2C Glasgow
Irvine, Nathan 2C Liverpool
Jones, George I 2C Liverpool
Jones, Hubert H 1C Cardiff
Kirk, Robert .. 2C W Hart'l
Kirk, Thos E 1C Leith
Kirsop, S B .. 1C N Shields
Knight, John .. 2C Liverpool
Leitch, Chas .. 2C Glasgow
Lewis, James M 2C Cardiff
Liddicoat, W J 2C Plymouth
Longstaff, J N 1C W Hart'l
McMeikan, R.A 1C Glasgow
M'Mullen, Alex 1C Barrow
Morrow, R J .. 2C Barrow
Murphy, J C .. 2C Cork
Nash, Valentine 2C Barrow
Nicoll, Alex .. 2C Leith
Polley, Fred L 1C Barrow
Roberts, F C 2C London
Robertson, J F 1C Leith
Rutherford, R G 1C Glasgow
Seago, Alf G... 2C W Hart'l
Speech, C G .. 2C London
Steel, John A .. 1C Liverpool
Stewart, W M 1C Glasgow
Storer, C A .. 1C W Hart'l
Stratton, Herbt 2C London
Taylor, Arch .. 2C Liverpool
Thorburn, W L 2C London
Webb, Thos H 2C London
Wilkinson, R .. 2C London
Willis, J W J 1C Leith
Wilson, John E 1C Cardiff
Wood Henry .. 2C N Shields
Wravtt, Geo A 1C London

June 29th

Barclay, C S 1C Liverpool
Barlow, George 2C N Shields
Bell, Ernest W 2C Sunderl'd
Bigelon, A G 2C Sunderl'd
Blackburn, G 1C N Shields
Brown, Percy .. 2C Sunderl'd
Buchanan, W P 2C Greenock
Campbell, Wm 2C Greenock
Cann, W H E 2C Bristol
Charnock, J F 2C London
Cooper, George 2C Liverpool
Davidson, A .. 1C Greenock
Daw, Chas F 2C Bristol
Dickinson, R W 1C Sunderl'd
Downing, S. H. 2C Hull
Emmett, A. A . 2C N Shields
Fraser, James.. 2C Aberdeen
Fraser, Wm H 1C Aberdeen
Garriock, Robt. 2C N Shields
Gorley, Jas W. 1C London
Halliday, Fred 2C Sunderl'd
Halter, A W .. 2C London
Hart, Edwin .. 1C Hull
Henderson, B.G 2C Liverpool
Hookey, H. R. 1C Hull
Jones, Wm. O 2C Liverpool
King, Alfred .. 1C Sunderl'd
Lawson, G .. 1C Hull
Malabar, H. .. 1C Liverpool
M'Donald, John 2C Greenock
Mews, A E D 1C Sunderl'd
Morgan, S. R. 2C Bristol
Murphy, John J. 2C Liverpool
Paddon, Wm .. 1C Sunderl'd
Pearse, Wm. J 2C Liverpool
Phayre, A G. 1C Liverpool
Pinkney, T W 1C Sunderl'd
Ried, Thos. H 1C N Shields
Riss, Hugh E. . 2C Bristol
Ross, Alexander 1C Aberdeen
Sangster, C. C 2C London
Scarrow, R. P 2C Liverpool
Slater, Joseph A 2C Liverpool
Ward, Samuel . 1C Sunderl'd
Waugh, W A 1C N.Shields
Wilson, R P... 2C Bristol
Wilson, H C .. 2C N Shields
Withers, T D 1C Liverpool
Wolsey, Edwd 2C Bristol

July 6th

Alexander, Wm 1C Glasgow
Boyd, James .. 1C Leith
Bradshaw, L P 2C Liverpool
Brown Percy .. 1C Liverpool
Campbell, J. A 2C Glasgow
Colquhoun, J. A 1C Glasgow
Cranston, G. M 2C Glasgow
Davies, John G 2C London
Elson, Wm H 2C London
Emery, Thos .. 2C Liverpool
Finn, Thos .... 1C Liverpool
Gray, Andrew.. 1C Glasgow
Hall, Harrison 2C Liverpool
Hart, James N 1C London
Hauxwell, L .. 2C Belfast
Hendry, Alex .. 2C Glasgow
Henderson, J W 1C Glasgow
Keir, Robt D . 2C Glasgow
Lamb, John.. . 1C Liverpool
Lanigan, Mich 1C London
Lee, Alex S .. 2C Glasgow
Marshall, Leon 2C Liverpool
Merry, H E .. 2C Cardiff
Mercer, H M 1C London
M'Nicoll, Jas S 2C Glasgow
Mugford, G R C 1C Liverpool
Munro, Alex. S 2C Glasgow
Nicholl, Alfred 2C Falmouth
Nicol, Wm ... 1C Glasgow
Osborne, Jas O 2C Belfast
Phelan, Rich .. 2C Liverpool
Pontet, Henry 1C Liverpool
Ray, Chas H . 1C South'ton
Roberts, W B 1C Liverpool
Russell, Douglas 2C London
Saunders, C W 2C London
Shellard, Fredk 2C Cardiff
Swanson John 1C Leith
Thomas, Arch 2C Liverpool
Tomlinson, L T 2C London
Walls, Alex .. 2C Glasgow
Wilson, Alex A 1C Glasgow

July 13th

Barclay, Wm . 2C Greenock
Barnett, Wm J 2C London
Bigmore, R W 2C London
Black, Jas D .. 2C Liverpool
Butler, Joseph 1C London
Clement, H.H.J. 1C Greenock
Curwell, T. W. 2C Liverpool
Dennier, W H S. 1C N.Shields
Denton, Ernest 1C Liverpool
Devonald, O E 1C Liverpool
Dobbin, J. H .. 2C Barrow
Exley, H. H. .. 2C Liverpool
Goodman, L .. 2C London
Harvey, A. M. . 1C London
Howes, Geo. A. 2C London
Irwin, Thos C 1C Liverpool
Lamplough, H E. 2C N.Shields
M'Gee, Wm B. 2C Liverpool
M'Larty, Arch. 1C Greenock
Niblock, S J G. 1C Dundee
Parker, F B .. 2C Hull
Richardson, J.M. 2C Greenock
Thomas, Walter 1C Liverpool
Thomson, J. B. 2C Dundee
Vernon, G. S. G 2C Dundee
Vie, Edward .. 1C N Shields
Watson, S. E. 1C Hull

July 20th

Allen, Wm H. 2C W Hart'l
Andeen, John .. 1C Glasgow
Anderson, J W. 1C N Shields
Baird, William 1C Glasgow
Baird, E L H 1C London
Bald, Harry B. 2C Leith
Campbell, G M 1C South'ton
Congdon, W J 1C Liverpool
Coulthard, J. 1C N Shields
Davidson, A H 1C Glasgow
Dodd, Thos G 1C Glasgow
Donald, A L .. 2C South'ton
Duncan, W K 2C Cardiff
Edwards, C. E. 1C South'ton
Gow, Robt. W. 1C Liverpool
Guthrie, Jas A 1C N Shields
Hassall, Chas . 1C Liverpool
Hill, Charles M 2C London
Holt, Charles F 1C N Shields
Houston, John 1C Glasgow
Hunter, Alfred 1C W Hart'l
Jobson, Thos F. 2C London
Kirk, George N 1C Leith
Kirkaldy, Alex 2C Liverpool
Leek, John S .. 1C Glasgow
Martindale, R J 2C Liverpool
Maxwell, W. H. 1C London
Mitchell, W J 1C South'ton
M'Lachlan, A 2C Glasgow
M'Lean, George 1C Glasgow
M'Nab, Wm .. 1C Glasgow
Moodie, George 2C Liverpool
Moore, Joseph 1C Liverpool
Moore, R R .. 2C N Shields
Nicholas, W G 1C London
Noble, Alex J 1C London
Owen, Henry C 2C Leith
Pattison, Percy 2C W Hart'l
Peters T W .. 2C Cardiff
Porter, Jas .... 2C Glasgow
Posgate, Percy 2C London
Prince E F .. 1C South'ton
Pringle, W H 1C W Hart'l
Roberts, W H 1C London
Roberts, G B S 2C Glasgow
Rossiter, Wm .. 2C London
Smith, William 1C Glasgow
Stratharis, N J 2C Leith
Swanson Jas .. 1C Glasgow
Thomas W F A 2C Cardiff
Thomson, W A 1C London
Todd, Frank .. 2C London
Turner, William 2C W Hart'l
Vaughan, J F 2C Liverpool
Walton, Robert 2C N Shields
Watt, John .... 1C Glasgow
Whitmore, J W 1C N Shields
Wilson, Thos E 2C Liverpool
Youldon, F W. 1C London
Young, Robert 2C Glasgow

The Marine Engineer
And Naval Architect.
LONDON, SEPTEMBER 1, 1907.

CABLEWAYS USED ON SHIP-BUILDING BERTHS.

THE country meeting of the Institution of Mechanical Engineers was well attended at Aberdeen this last month, and the local committee and the proprietors of large works in the neighbourhood gave the members, who were desirous of attending, the warmest welcome. We must draw the attention of our readers to such papers as were read by members which are particularly applicable to ship-yards and the like. Mr. John M. Henderson, of Aberdeen, has described well a new system of cableways, which have been used for ship-building berths. The first installation was completed for the Jarrow yard, serving the berth upon which the battleship the *Lord Nelson* was built, and since that time two larger berths have been fitted with this apparatus. The enquiry for such a system, with overhead cables and trolleys, as applied to ship-building berths, was made by Messrs. Palmer's Company, with the condition that the steel cables should be suspended 100 feet or more above the ground, that they should be worked by electricity, that the weights to be moved should be several tons, and that the load should be movable transversely, with the operator placed so as to have a complete view of his work. These requirements seem to have been admirably fulfilled by the structure we describe hereafter, and it appears to be of much less cost than the apparatus, now so well-known, of cantilever cranes and steel structures the whole length of the berth, with cranes overhead. The present apparatus consists of two pillars, with an overhead cross girder, both situated at either end of the berth, with at least four main cables between the two heads. The pillars at both ends of the berth are fixed by a pivot upon strong concrete seats. The pillars are themselves allowed to rest at an angle of about 60°, both leaning outwards, and away from each other. Vertical pillars, with buttresses, were not considered to be satisfactory, both on account of excessive cost and the ground space which would have been occupied by the props and their foundations. The cross-girders were, for convenience in erection, made in two parts, an upper and a lower, and were made sufficiently strong to carry the weight and tension of the four cables, and the weight of the load carriages with their load. The whole apparatus is firmly fixed by carrying down the ends of the cables from the upper part of the pillars to distinctive anchorages, formed of solid concrete blocks. The upper carriages carry a cable between them and are arranged to travel transversely under the direction of the operator. The weights are lifted and carried by an electrically-controlled lifting winch, with a carriage constructed beneath it to carry the operator. Special collecting gear and connections are provided on each load carriage, for the purpose of contact, and bare conductors are supplied to supply energy to the load carriage motor, and for the control of the end carriages. On the upper surface of the wires a bogie is placed, which is provided with wheels for running on the supporting cables, and also for making contact with the trolley wires. As to the general utility of the system, experience has proved its excellence. Some features which were questionable have absolutely been found of advantage. For instance, the mounting of plates for ship-work upon the elastic foundation of the cables has proved of advantage, as when the plate has been brought within an inch or two of its position, the end of a spanner passed through a hole in the plate and the corresponding hole in the frame, pinches the plate into the required position.

TESTING OF MATERIALS.

WE may also notice a paper read by Mr. Charles E. Larard, of London, upon an electrically-controlled single-lever testing machine and some torsion tests. Much attention is being paid at present to the testing of materials, and the results of such tests have an impressive result upon the general design and upon the proportions of parts. A recent addition to the equipment in the Mechanical Engineering Department at the Northampton Polytechnic Institute, London, is the latest of Mr. J. Hartley Wicksteed's testing machines as supplied by Messrs. J. Buckston & Co., of Leeds. This machine was the result of various visits made by the author to such places where testing machines have already been in use; and, seeing that this machine would probably be required for research purposes, a specification was made including certain definite requirements, and Mr. Wicksteed is to be congratulated that the present machine has great precision of control with respect to the time rate of straining and loading either slowly or very quickly over a large range. This remarkable control is obtained in this machine by the use of two electro motors with wide speed ranges, the high range in the rate of straining by hydraulic pressure, and the fact that the handle and other adjustments are controlled from one position. The machine is one of Wicksteed's vertical single-lever machines, satisfying in every respect the requirements of the Board of Trade. The maximum stress that can be impressed on specimens is 150,000 lbs., and torsion tests on short specimens may be made up to a moment of 400,000 inch lbs. The effort upon the lever is made by a movable poise weight, which can be altered, the first weight being 1,000 lbs., and there are two additional side weights of 500 lbs. each. Further, there

are a series of suspended weights, amounting to 1,250 lbs., at the end of the lever, which, being added to the full 2,000 lbs. poise weights, will produce a full pressure of 150,000 lbs. upon the specimen. The movement of the poise weight in both directions may either be by hand, or it may be moved by an electric motor which can be thrown in or out at pleasure. By an arrangement of resistances this operation of the motor may be adjusted for either slow or rapid movements either forward or backward. The movement of the poise weight is arrested by a magnetic break at the moment when the positive end of the lever approaches the bottom stop, this being necessary to estimate fairly the breaking weight. An excellent indicator to show the movement of the free end of the steel yard is brought in front of the operator controlling the handle movements, so that it is not necessary to watch the movements at the end of the beam. This, with a four-inch distance between the fulcrum and the test-piece, is clearly shown by a vernier scale. In the present machine no less than a dozen handles, controllers or levers may be worked from a single operator in one position, which has been found very useful, so as to give full control to one person in place of two, three or more observers, as are required in other testing machines. There is also an autographic recorder or chronograph which will give a registered record of any test, which is a great advantage.

STRANDING BUOY.

THE terrible disaster last winter at the Hook of Holland has induced people to think how such an emergency can be met in the future with some chance of success, and in following this line of thought Mr. Bredsdorff, a director of the Flensburger Shipbuilding Company, of Flensburg, has invented what he terms a stranding buoy.

The idea is that when a ship is on a lee shore communication can be set up between the ship and the shore by means of a buoy fitted with a small sail and having the end of a fine line attached to it. When the buoy is thrown overboard it is blown to the shore, and brings with it the line from the ship to the life-saving crew, and enables them to bring a heavier rope from the ship to the shore or *vice versa.*

It will be recognised that for shallow shores, such as the Dutch coast or coast of Jutland, the stranding buoy should be of great advantage, and it is somewhat surprising that it has not been suggested before.

The buoy, which is illustrated in the adjoining diagram, is made of yellow metal and measures about 36 inches in length, and, as can be seen, is made of a boat shape and fitted with a mast, sail and four handles or grips. The weight is under 25 lbs., and immediately the buoy enters the water the ballast keeps it upright.

In the upper part of the buoy an aperture is provided, having a water-tight cover, so that the buoy can serve as a receptacle for important documents, ship's papers and letters.

It will be recognised that in case of foundering in the open sea such a buoy has a better chance of being picked up than the old-fashioned bottle.

It may be pointed out that the stranding buoy is also a lifebuoy fairly able to support two or three persons in the water. In this case the buoy is provided with a store of provisions within its body. For bringing a line on board a pilot boat in a high sea the buoy would also serve another useful purpose.

Stranding Buoy.

Mr. ROBERT LESLIE, R.N.R.

IT is with pleasure that we are able to present our readers with a portrait of Mr. Robert Leslie, R.N.R., Supt. Engineer P. & O. S. N. Coy., a Vice-President of the Institute of Marine Engineers, and one of its earliest members. Mr. Leslie served his apprenticeship with Messrs. John Scott & Sons, Greenock, and as soon as it was completed he joined the service of the P. & O. S. N. Coy. in 1874, his first ship as Assistant Engineer being the *Surat.* He made two voyages as Fifth Engineer and then joined the *Hindostan* as Fourth, being promoted to Third after another voyage, afterwards being transferred to the old *China*, in which ship he received promotion to Second Engineer, and ran for some time on the China and Japan line, but being taken sick was invalided home for a short time. He was appointed to the *Rohilla* when new as Third Engineer, but was promoted to Second before the ship left England, was transferred

to the *Venetia* in Bombay, and went on the Venice and Trieste station for a few months and then came home, leaving the *Venetia* at Messrs. Denny's for new machinery and boilers. He then joined the *Brindisi*, building at Sunderland, and sailed in her as Second Engineer out to Sydney and back to Bombay, when he was transferred to the *Adria* as Chief Engineer at the age of twenty-five. He served in this capacity in the *Adria*, *Avoca*, *China*, *Sumatra*, *Bokhara*, *Chusan*, *Deccan*, *Tasmania*, and *Britannia*, and had the satisfaction of making a record voyage to Australia of thirty-five days. In 1888 he was appointed to the position of manager of the Company's new works at the Royal Albert Docks, London, and during his term of office there had the pleasure of being complimented by the Lords of the Admiralty for the expeditious and thorough manner in which the Hospital Ships *Malacca* and *Coromandel* were fitted out by the Company's workmen under his supervision. He also had the honour of being complimented by the Admiralty for the excellent manner in which the Company's steamers were fitted out as transports for South Africa during the Boer War. In 1903 the Chairman and Directors conferred on him the great honour of the position of Supt. Engineer, and his greatest pleasure in life is to carry out his duties so as to give them satisfaction in every way.

Mr. Leslie commands the respect of the many Engineers under his charge, and enjoys the esteem of the numerous business men with whom his famous firm have dealings, being regarded as a man of high integrity, always willing to give a courteous hearing, amid his multifarious duties, to anyone who has anything to show which might prove of interest to the Peninsular and Oriental Steam Navigation Company.

Mr. Leslie is a member of the Institution of Naval Architects and the Constitutional Club, Northumberland Avenue, London

Mr. Robert Leslie, R.N.R. *Photo by Russell & Son, London.*

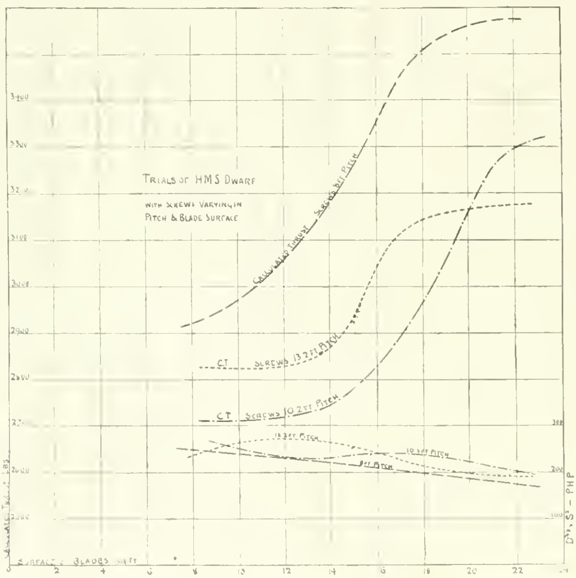
THE SCREW PROPELLER.

XIV.

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

THE rules stated in the last article will give a diameter appropriate to the indicated horse power per revolution in one case, and a diameter proper for an engine having a certain size of L.P. cylinder in the other. Moreover, it will be found that the diameters thus obtained are in accordance with good recognised practice, as well as satisfying theoretical requirements. It must not be assumed, however, that no other diameter will give as good results, for it is more than likely that approximating to the diameter calculated by these rules there are others which will, with a change in pitch or surface, produce a screw more efficient in a particular ship than even these standard ones. In fact, considerable reduction in the diameter of screws have been necessitated at times from considerations of draught of water, and been compensated for with most satisfactory results by an increase of both pitch and surface. In the case of propellers driven by turbines the diameter is always very much reduced to suit the high speed of revolution necessary for efficiency in working of the turbines themselves, and also to limit the high peripheral speed at the tips of the screws to a reasonable rate, and generally to produce a propeller that is safer and more reliable than would be one of larger diameter under the same conditions. Such propellers have a very excessive blade area in proportion to their disc area, although it is not large in proportion to the torque of the shafts; in fact, to-day may be seen propellers bearing a strong likeness to those of sixty years ago, when smallness of diameter and great length of screw were still found successful when driven at high revolutions by geared engines. To-day, however, the tips are rounded so that each blade is almost a complete circle.

The Admiralty at a very early stage in the history of the screw propeller made several experiments besides those of the *Rattler*, with the object of determining the effect of variation in area of effective surface of blades as well as in the pitch ratio; and not the least interesting or important are those very numerous ones carried out on H.M.S. *Dwarf* in 1845, some of which are collected and sorted in Table XX.



It is much to be regretted, however, that no one could produce an instrument in those days which should show the mean amount of thrust and the variation in thrust with a fair approximation to accuracy. It is evident that the dynamometer used on those trials did not possess those necessary qualities, for its records are quite inconsistent one with another, and, even with the corrections made by Mr. Bourne, are far from satisfactory for any real scientific purposes. As a rough check on modern calculations, however, they are of some small service, and if taken in conjunction with the trials of H.M.S. *Rattler*, when probably the same instrument was used, these trials have an interest beyond the historic one.

H.M.S. *Dwarf* was a small merchant steamer built by G. Rennie in 1841, and purchased by the Admiralty for harbour and coast service. She was 130 feet long,

* For Articles I to XIII see last thirteen issues

16·5 feet beam and 6·4 feet mean draught of water; the displacement was 131 tons, the immersed midship section 58·4 sq. ft., and the wetted skin 2,363 sq. ft.; the water-lines were fine, the prismatic co-efficient being only 0·6. The engines were geared to the screw shaft, and had cylinders 40 in. diameter and 32 in. stroke of piston. The screw was in every case a two-blade common one of 5 ft. 8 in. diameter, and the pitch, which was true in those in Table XX., was 8 ft., 10·32 ft. and 13·23 ft., so that the pitch ratios varied from 1·42 to 2·33. In the series of screws used on these trials the surfaces were 8·9 sq. ft., 13·3 sq. ft., 17·8 sq. ft. and 22·2 sq. ft.; in the latter case the ratio of blade area to disc area was as high as 0·888. To check the thrust the resistance of the ship has been calculated by taking the wetted skin and allowing the friction per square foot as $1\frac{1}{4}$ lb. at 10 knots.

The gearing of engine to propeller shaft was such that the speeding might be 3·13, 4·0, or 5·16 of the screw to one of the engines, so that to preserve the speed at about 9 knots the engine revolutions varied from 28 with the fine-pitched screw to 40 with the coarsest pitch and smallest surface. It will be seen by reference to Table XX. that this introduced a very serious disturbing factor, for whereas the engine losses were only 39 I.H.P. at the low revolutions, they were as high as 92 I.H.P. at the highest.

In each group of trials it will be noticed that the propeller with the least surface produced the highest speed, and in the first two groups these propellers gave the best efficiency as judged by $D^{\frac{2}{3}} \times S^3 \div$ P.H.P.

Seeing that a modern screw as found in ships driven by turbines will have a surface ratio under 0·60, it will be admitted 22·2 sq. ft. and 17·8 sq. ft. of blade area was excessive, and it is somewhat surprising to find that such screws should work with the large amount of slip recorded on these trials; but perhaps it will still more upset all preconceived ideas when it is seen that the difference in percentage between the screw with 22·2 sq. ft. surface and 8·9 sq. feet was only trifling. This leads to the suspicion that they were badly placed in the run of the vessel, so as to lack a good water supply. This suspicion is confirmed by the large amount of augmented resistance which occurs with them.

Now-a-days such a ship as the *Dwarf* would have a screw of about 5 ft. diameter and 7 ft. pitch, but there would be three blades and the total surface would not exceed 9·5 sq. ft., seeing that the ship would be propelled at 9 knots with direct engines of about 105 I.H.P. If, however, a two-bladed screw were fitted, its surface would be only 7·9 sq. ft., so that the smaller screw tried in the *Dwarf* would not be far from accord with modern practice, and therefore to have had such a slip as 30·4 per cent., with a pitch of 8 ft. and 44·7 per cent. with the coarse pitch, confirms the impression that none of these propellers could have had a crucial test.

The irregular working of the dynamometer may have been due to the same cause, seeing that it was with the screws of coarser pitch that differences were so great and the indications so utterly inconsistent.

TABLE XX.

TRIALS OF H.M.S. "DWARF," IN 1845, WITH SCREW PROPELLERS OF DIFFERENT PITCH AND SURFACE.

Description of Screw	Common Two Blades 8 ft. pitch 5·67 ft dia				Common Two Blades 10·32 ft. pitch. 5·67 ft dia				Common Two Blades 13·23 ft pitch. 5·67 ft dia.			
No. of Trial.	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Surface of Blades, sq. ft.	22·2	17·8	13·3	8·9	22·2	17·8	13·3	8·9	22·2	17·8	13·3	8·9
Pitch Ratio	1·42	1·42	1·42	1·42	1·82	1·82	1·82	1·82	2·33	2·33	2·33	2·33
Surface Ratio	0·888	0·712	0·532	0·356	0·888	0·712	0·532	0·356	0·888	0·712	0·532	0·356
Revolutions per Minute	146·2	152·7	155·4	166·0	123·6	123·3	127·1	139·8	106·6	111·8	114·2	125·9
Slip per Cent....	25·0	25·7	27·1	30·4	29·3	30·8	33·5	36·4	38·7	39·5	40·4	44·7
Speed of Ship, knots...	8·64	8·96	8·94	9·11	8·89	8·74	8·61	9·05	8·52	8·83	8·83	9·08
Indicated Horse Power	130·7	151·5	137·0	168·8	143·8	136·3	148·8	154·0	149·4	166·4	161·7	176·9
Do. Thrust, lbs.	3700	4095	3637	4200	3721	3535	3290	3527	3500	3845	3333	3538
Dynamometer, do. do.	3049	3347	3176	3396	2047	2144	2404	1875	3031	3904	2632	3893
Do. do. corrected, do. ...	2867	3069	2733	3136	2755	2543	2800	2643	2621	2755	2643	2620
Calculated do. do.... ..	3587	3503	3137	2940	3304	2954	2733	2714	3179	3142	2848	2829
Resistance of Ship do.... ..	2394	2555	2546	2651	2517	2431	2367	2625	2323	2488	2488	2637
Augmented Resistance do.... ..	1193	948	591	289	787	523	366	89	856	654	360	192
Resistance Horse Power	63·7	70·3	69·9	74·2	68·8	66·1	62·6	72·8	60·8	67·3	67·6	73·4
Screw Friction do. do.	16·5	15·4	12·1	10·5	11·7	9·37	7·60	6·97	9·37	8·70	6·89	6·27
Engine Losses do. do.	19·0	39·7	38·8	76·0	41·9	46·8	68·5	71·7	56·8	72·5	77·4	92·0
H.P. Delivered by Screw	95·2	96·4	86·1	82·3	90·2	80·1	72·7	75·3	83·2	85·2	77·4	78·6
$D^{\frac{2}{3}} \times S^3 \div$ I.H.P.	127	126	139	120	125	141	115	129	106	111	129	111
Do. $\div$ P.H.P.	174	200	221	245	200	239	229	263	191	216	269	250
General Efficiency R.H.P. $\div$ I.H.P.	0·488	0·464	0·510	0·440	0·478	0·489	0·421	0·473	0·408	0·406	0·417	0·415
Engine Efficiency P.H.P. $\div$ I.H.P.	0·727	0·635	0·630	0·490	0·627	0·590	0·500	0·489	0·557	0·512	0·478	0·444
Revolutions of Engines	28·3	29·6	30·1	32·2	30·9	30·8	31·8	34·9	34·1	35·7	36·5	40·2

The corrections suggested by Mr. John Bourne harmonize better one with another, but some of them are still inconsistent.

Altogether these trials, though interesting and extensive and having the promise of great things at the start, will not bear a close investigation, and could have thrown but very little light on the path that had to be trodden by our predecessors in propeller design. It would no doubt be of great interest to them to find that with the same surface of blades the slip per cent. increased with the increase of the pitch—in fact, that the pitch increase was as 1 to 1·65, the slip increase was as 1·548 with the 22 sq. ft. of blade and 1 to 1·49 with the 8·9 sq. ft But this information could not

As in the case of the *Dwarf*, the trials were made at speeds low enough to avoid complications due to form of ship. The slow running of the geared engines enabled the taking of the indicator diagrams with fair accuracy; but again the dynamometer records do not seem to be correct one with the other. It is, of course, possible that the seeming inaccuracy of this instrument may be due to the ship being in water varying in depth during the series of trials. For example, in No. 1 Trial a speed of 8·36 knots was attained with a thrust of 4,713 lbs., while with the same screw on another occasion the speed was 8·54 knots when the thrust was only 3,416 lbs.; on both occasions the indicated thrust was about 5,000 lbs.

TABLE XXI.

Trials of H.M.S. "Minx" in 1847-8 with Screws of different surface.

Description of Screw. Common Screws all 4·5 ft. Diameter. Two Blades.

Number of Trial	No 1	No. 2.	No 3.	No 4.	No. 5	No. 6.
Pitch of Screw	5·0	5·83	5·83	5·83	5·83	5·0
Surface of Blades	7·20	4·93	5·97	7·10	7·10	7·20
Pitch Ratio	1·110	1·295	1·295	1·295	1·295	1·110
Surface Ratio	0·450	0·308	0·373	0·443	0·443	0·450
Revolutions per Minute	248·9	237·8	232·0	218·7	256·9	250·1
Slip per Cent.	32·0	41·7	39·7	37·7	38·0	28·0
Speed of Ship	8·36	7·97	8·04	7·85	9·13	8·54
Indicated Horse Power	188·1	178·3	177·7	168·4	252·1	193·4
Do. Thrust	5000	4240	4335	4350	5600	5110
Dynamometer Thrust	4713	4458	4437	4372	4282	3416
Calculated Thrust	2555	2000	2124	2085	2850	2555
Resistance of Ship	2169	1963	2002	1909	2576	2262
Do. do. Augmented	386	37	122	176	274	293
Do. Horse Power (R.H.P)	55·7	48·1	49·4	46·0	72·6	59·2
Screw Friction	10·0	7·6	8·6	8·5	13·8	10·2
Engine Losses	112·5	121·7	116·1	109·7	158·4	115·3
Horse Power delivered by Screw	65·6	49·0	53·0	50·2	79·9	66·9
$D^{2/3} \times S^3 \div$ I.H.P.	128·6	123·4	125·8	126·6	112·3	125·4
Do. $\div$ P.H.P.	369	449	422	425	354	363
General Efficiency R.H.P. ÷ I.H.P.	0·320	0·292	0·300	0·295	0·310	0·331
Engine do. P.H.P. ÷ I.H.P.	0·349	0·275	0·298	0·298	0·317	0·346

have been of much real assistance to them; on the contrary, it is not unlikely that it led them into some of those crudities of diameter and pitch already alluded to and exemplified in the case of the *Archer*.

In 1847 some further experiments were made on H.M.S. *Minx* with screws of various kinds for the purpose of finding the comparative merits of varying pitch as advocated by Bennett Woodcroft, Atherton and others, and comparing their performance with that of similar screws on F. P. Smith's principle. From these a group has been formed of common screws with varying areas of blade surface, and their performance is given in Table XXI.

The *Minx* was an iron ship 131 ft. long, 22·1 ft. beam, and 5·2 ft. draught of water; the displacement was 203 tons, immersed midship section 82 sq. ft., wetted skin 2,700 sq. ft., and prismatic co-efficient 0·661. She was propelled by geared engines having cylinders 34 in. diameter and 33 in. stroke of piston.

Notable Vessels. H.M.S. *Agamemnon* (by Messrs. Beardmore), the *Lusitania* (by Messrs. John Brown & Co.), and an experimental gunboat (fitted with gas engines by Messrs. Beardmore) are three notable vessels which were lying not far from one another during the month of August off Rosneath Point; the first and last-named being ventures, the results of which will be eagerly watched for by many in connection with the mercantile marine. The comfort of the majority and the luxury of the few are amply provided for in the munificence and magnificence of the appointments throughout in the *Lusitania*, and on the eve of her departure for New York we seek to express our best wishes for a successful and profitable voyage. She is not only a venture for the Cunard Co., but for the nation; may she satisfy the highest hopes of both. With regard to the results attained by Messrs. Beardmore in their experimental gas engine and plant it is somewhat premature to say that they have demonstrated the possibilities of immediate adoption of gas in preference to steam for sea-going vessels, but at least it has been shown that economy lies in that direction. Messrs. Beardmore are to be congratulated on the results obtained, and when the season is ripe for the details to be disclosed these will be welcomed.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

The "Kronprinzessin Cecilie."

On Wednesday, the 7th August, the new Nord Deutscher Lloyd liner *Kronprinzessin Cecilie* was inspected by a party, amongst whom I was one, as she came into Southampton on her maiden voyage to the westward. The vessel is practically a sister to the *Kaiser Wilhelm der Zweite*, which has made herself so great a favourite in the New York trade, and differs little in general plan from the two earlier vessels, *Kaiser Wilhelm der Grosse* and *Kron Prinz Wilhelm*. The Nord Deutscher Lloyd will, by the advent of this fourth member of the quartet, be enabled to make a weekly despatch of one of the fastest mail steamers afloat from Bremen on Tuesday, with a call at Southampton and Cherbourg on the following day.

The *Kronprinzessin Cecilie*, like the previous vessels, was built by the Vulcan Company of Stettin, from whose yard she was launched by the royal lady whose name she bears on the 1st December, 1906. Though the Germanisher Lloyd, in whose register she bears the highest class, puts her down as a four-decked ship she has, in reality, some seven decks, of which the uppermost or sun deck carries her steel boats, and here also are two Vienna cafés, one for smokers and one for non-smokers, the aftermost of the two having a verandah —a convenience which seems to be greatly appreciated by passengers. This boat-deck is some 447 ft. long whilst further aft there is a similar but shorter deck at the same level. At the fore end of the upper promenade deck, looking out over the fore waist is the reading and writing room. Aft of this room are some of the special suites for first-class passengers the social hall and the first-class smoke-room. The latter is designed to give a considerable amount of privacy and the utmost degree of comfort which can be combined with a spacious apartment. The main saloon is capable of seating some 512 persons at one time. It is arranged with a considerable number of small tables for parties, whilst the comfort of passengers is increased by the fact that at each corner there is a sort of wing, which enables two or three tables to be placed in semi-privacy. The shaft over the saloon is especially striking with its white pillars and galleries. In one of the latter is a dining-room for children. This is decorated in a style calculated to appeal to their juvenile tastes. Accommodation is provided for altogether 742 passengers of the first-class with 327 second, and 740 third-class, whilst the crew numbers 665 persons. As special accommodation there are two Imperial suites, which are really dainty self-contained flats, comprising dining-room, drawing-room and bed-room, with lavatory and bath-room accommodation. In the baths I notice a certain ribbing of the porcelain at the bottom, a little point which may afford convenient foot-hold to passengers in rough weather. Only less sumptuous than the Imperial suites are the eight *cabins de luxe* which have one general sitting-room instead of the two, furnished in the more expensive suites. Twelve extra large-sized state rooms having private bath rooms attached, but no parlours, are described as state cabins. On the whole it may be said that the passenger accommodation is excellent, whilst the cuisine—to judge by the sample meal given to the guests at Southampton—is equal to that to be obtained at the best London hotels. The Rhine salmon, for example, was as near perfection as may be.

To return to the vessel herself, however. She is of 706 ft. 6 in. in length, 72 ft. beam, and 35 ft. 6 in. from keel to promenade deck. At the designed draught of 30 ft. her displacement is 27,000 tons, whilst her gross register is 20,000 tons, the launching weight having been 11,000 tons. Seventeen transverse bulkheads and a longitudinal bulkhead in the engine rooms divide her hull into nineteen compartments, whilst the double bottom is divided into twenty-six compartments. The bulkheads have Stone-Lloyd doors, and the other appliances for safety are exceptionally numerous, twenty-eight boats being carried, whilst the pumping power is not only large, but is so arranged that it can be made use of even if the main engine rooms be flooded.

There are four sets of quadruple expansion engines driving two shafts. Each set of engines is in its own compartment, whilst the boilers are divided into four groups, each separated from the rest. The engines, which are balanced on the Schlick system, are of 45,000 I.H.P., whilst the heating surface of the nineteen boilers is 107,643 sq. ft. The consumption of coal is put at 700 tons a day. The bunkers are of 5600 tons capacity, and the stokehold squad number 291 men.

On her maiden voyage she was in no way pressed, but leaving Southampton at 2-30 p.m. on the 7th August, she proceeded from Cherbourg at 9 p.m. the same night, and was off Fire Island at 1 p.m. on the 13th. As she would be off Sandy Hook about two hours later, her voyage, allowing for difference in time, would be about 5 days 23 hours.

Disasters.

There now seems hardly room for hope that the steamship *Nicaraguan*, of the Leyland branch of the Combine can be afloat. She was a steel screw steamship of 3643 tons gross register, built in 1891 by Messrs. Barclay, Curle & Co., of Glasgow. She was fitted with seven bulkheads and three decks, two being of steel, so that her hull was strongly constructed enough. A list of the crew which she signed on prior to her last departure from Liverpool has been published. It shows a total of 46 persons, including her master, Captain C. E. Shacklock, of Waterloo. She had four engineers, the chief being Mr. T. E. Davies also of Waterloo, with Messrs. T. Jones, J. B. Munro R. B. Johnston, and Robert Rennison as second, third, fourth and donkeyman respectively. There were also eight firemen and four trimmers in the engineering department. Besides the master there were three navigating officers, carpenter, boatswain, three quartermasters, nine seamen, an apprentice, six stewards, stewardess, two cooks and a purser.

The vessel left Port Tampa on the 2nd June for Dublin, called at Norfolk, Va., in the usual course and passed Cape Henry on the 8th June. Since that date nothing has been heard of her.

The same Company's *Darien*, which, like the *Nicaraguan*, once belonged to the old West India and Pacific Steamship Company, seems to be incurring a fine bill for her owners though the salvors seem confident of her eventual rescue. It may be remembered that this vessel went ashore on the coast of Colombia in January, 1907, and that since then she has been moving along the coast, whilst receiving the attention of the would-be salvors. They now report that the whole of the cargo has been removed from the ship, and that about £25,000 has been expended in these operations. The vessel in her damaged state is said to be worth little over £5000, and thus it is not likely that any further large sums will be spent on getting her afloat.

The Hamburg-American line has lost its steamship *Teutonia* by stranding in the Red Sea. She was a vessel of some eighteen years old, originally built for the Rickmers Line. She was, however, in the Hamburg service for many years prior to the outbreak of hostilities between Russia and Japan. When that struggle was in process she was acquired by the Russians who employed her under the name of *Oranienbaum* and then, after the conclusion of peace, resold her to the Hamburg Company. As a substantial profit was said to have been made over the transactions which took place between the Russian Government and the Hamburg line in regard to the purchases and resales of which the case of the *Teutonia* was merely one, it is probable that the account of the lost ship shows up well in the Company's books.

The Great Eastern Railway Company has limited its liability in respect of claims arising out of the lamentable disaster to their steamship *Berlin*. The total divisible amongst all claimants is between £25,000 and £26,000. In spite of this fact juries have been awarding large sums—one award, for example, amounted to no less than £8000 to those who claimed for the loss of relatives, and thus it is probable that the actual amount received by the bereaved will be a very small percentage of the nominal amount assessed by the juries, who, no doubt, in arriving at their figures, have thought that they ought to take into account the probabilities in regard to a reduction.

Another important disaster has been that of the mail steamship *Colombia* of the Pacific Steam Navigation Company's fleet. This wreck, like that of the *Teutonia* seems to have been accompanied by loss of life. For the vessel struck on Lobos de Tierra at two o'clock in the morning when on her voyage from Panama and Payta to southern ports, and sank in twenty minutes, taking with her one passenger and two seamen who refused to leave the vessel. The mails, specie and baggage went down with the ship.

But as the *Colombia* lies in but eight fathoms there is a fair prospect of salvage. The reports stated that the boilers exploded as the vessel went down. Once more let me remark —for the benefit of those unconnected with marine engineering—that boilers do not explode when steamers sink. They are much more likely to collapse. What gives the impression of explosion is the rush of steam caused by the admission of water to the heated furnaces and the throwing up of large quantities of ashes from the tunnel.

The Port of London.

Mr. Alex Wilson, a well-known and capable Liverpool solicitor, has written to the press a letter containing a very lucid summary of the position in regard to the Port of London. After stating the arguments for and against the establishment of a Harbour Trust, he arrives at the conclusion that the acquisition of the docks by such a trust is "almost necessary" if the trade of the port is to be retained. Further, he agrees —as every one except those who would obtain direct benefit from the continuance of the present state of things—that the present system must cease, and that barges be no longer allowed to use the docks not only free of dues, but without contributing to the actual expenses of passing them through the gates. He believes that the shipowner would gain from the change in that he would obtain greater promptitude in delivery. With one suggestion for economy contained in his letter I venture to disagree. To my mind the abolition of compulsory pilotage in the Thames would be a great mistake. As I read Mr. Wilson's remarks he would not necessarily abolish such pilotage in other ports than the Thames. That in itself is against the suggestion. For patchwork policy is always a mistake. Further, I cannot see any sound argument for the abolition of compulsory pilotage anywhere, although it is quite possible that such an alteration as is suggested might afford a noticeable increase in the work of the Admiralty Division of the High Court of Justice.

British Shipowners and the British Government.

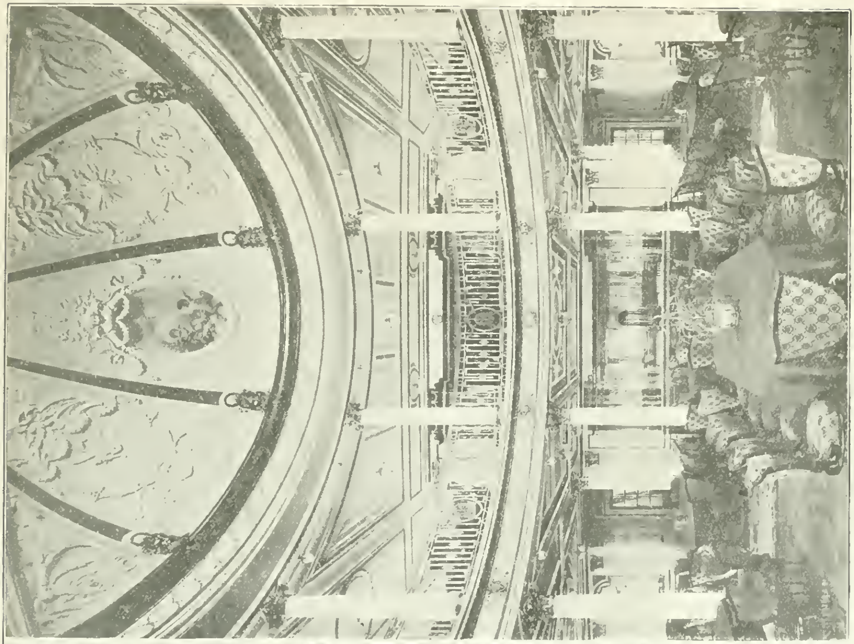
The practice of running ships under the British flag has undoubtedly its disadvantages. Apart from the costly and minute regulations enforced by the Board of Trade for the purpose of ensuring the safety of life and property, apart even from the suggestions that the State shall interfere with what it is pleased to call Shipping Rings—in plain English, apart from the proposal that freights shall be regulated in the interests of cargo owners—the shipowner has much of which to complain. A grievance which has grown rapidly of recent years is the neglect to afford him an efficient help in prosecuting his just claims against foreign Governments. In illustration of this statement one can cite the cases which arose during the hostilities between Russia and Japan, where such vessels as the *Knight Commander* were wantonly sunk by one of the combatants who has ever since simply refused to listen to the petitions of the aggrieved persons, and who has never had any real hint from our own authorities that it would be advisable to settle the claims. Now in the House of Commons, Mr. F. E. Smith, an energetic member of the opposition, calls attention to the case of the steamship *Eastry*. Over six years ago—in June, 1901—this vessel was damaged at Manila by collision with vessels belonging to the United States. Within two years of that time the American officials had recognised that the owners of the *Eastry* had a just claim against them, and even went so far as to include in the Presidential message to the Houses of Congress a suggestion that payment should be made. Twice since has reference been made to the case on similar occasions. But nothing has been done and the owners of the *Eastry* are still waiting for their money. This is a state of things incredibly shameful to both parties in this State. Imagine what Germany would have done under like conditions!

The Ellerman Line

has in its City branch added a fine vessel to its fleet by the launch from the yard of Messrs. Barclay, Curle & Co. of the *City of Paris*, which is believed to be the first vessel constructed for the Indian trade to be fitted with *suites de luxe* for the benefit of her saloon passengers. The *City of Paris*, which is of about 9000 tons gross, has quadruple expansion engines driving a single screw. On the other hand, the same service has sustained a serious loss by the stranding on the coast of Japan of their *City of Carthage*, launched from the same yard, in the earlier part of last year. At the time of her loss the *City of Carthage* was on a voyage from Philadelphia to Japanese ports. From the moment she struck her position was critical, as she was hung on rocks amidships and gave immediate signs of straining, eventually breaking amidships and sinking.

THE "LUSITANIA."

We are enabled in the present issue to give some illustrations of this most magnificent ship. By the contract between the Cunard Company and the Government the *Lusitania* and her sister *Mauretania* are to have a sea speed of $24\frac{1}{2}$ knots in moderate weather. Subject to that guarantee on the part of the builders and owners, the Government, on its side, undertakes to lend the Company £2,600,000 on debentures at $2\frac{3}{4}$ per cent. interest towards the cost of the vessels, and in addition to pay them an annual subsidy—if the use of that word be allowable in such a case as this, where a substantial return is given by the shipowner for the payment made to him—amounting to £150,000 per annum. The *Lusitania*, built and engined by Messrs. John Brown, of Clydebank, is the first of the two vessels which are the outcome of this agreement. She was launched in June, 1906, and commenced her trials in July, 1907. Her principal dimensions are: Length overall, 785 ft.; length B.P., 760 ft.; beam, 88 ft.; moulded depth, 60 ft. $4\frac{1}{2}$ in.; gross tonnage, about 32,500 tons; designed draught, 33 ft. 6 in.; displacement, 38,000 tons. She has no less than eight decks, commencing with the boat deck, which, from a passenger point of view, is known as Deck A, for the Cunard Company avoids the use of grandiloquent titles such as some of its rivals affect. Deck B is the promenade deck; Deck C is technically known as the shelter deck. Below that comes the upper deck, Deck D; whilst Deck E, the main deck of the vessel, is the lowest deck with which first-class passengers are concerned. There, are, however, still three decks, known respectively as lower deck orlop and lower orlop. The appliances for safety are, as would be expected in a Cunard liner, at once extensive and complete. There is a double bottom for practically the full length of the ship, and this doubling is carried high up the side of the vessel beyond the turn of the bilges. No fewer than eleven transverse bulkheads are fitted, whilst there are also longitudinal bulkheads in the engine rooms and partial bulkheads in the coal bunkers. In view of her possible employment for purposes of war, bunkers are so arranged as to afford efficient protection from hostile attack to bottom, boilers and engines—all the machinery being situated well below the water line, as is the steering gear. Where it is necessary to pierce the bulkheads, water-tight doors, operated on the Stone-Lloyd system, have been fitted. The steering gear was supplied by Messrs. Brown Bros., of Edinburgh, and two complete telemotors have been fitted by them. The rudder, which moves through an angle of 35°, weighs 56 tons 8 cwt., and has an area of 420 sq. ft. It is composed of three steel castings. The stern port weighs 59 tons 8 cwt., and the spectacle frames for the propeller shafts 60 tons 4 cwt. The eyes for the two outer shafts are placed 90 ft. forward of the stern port. The stem is of cast steel and weighs 8 tons 3 cwt.



First-Class Dining-Room, upright view with Dome.

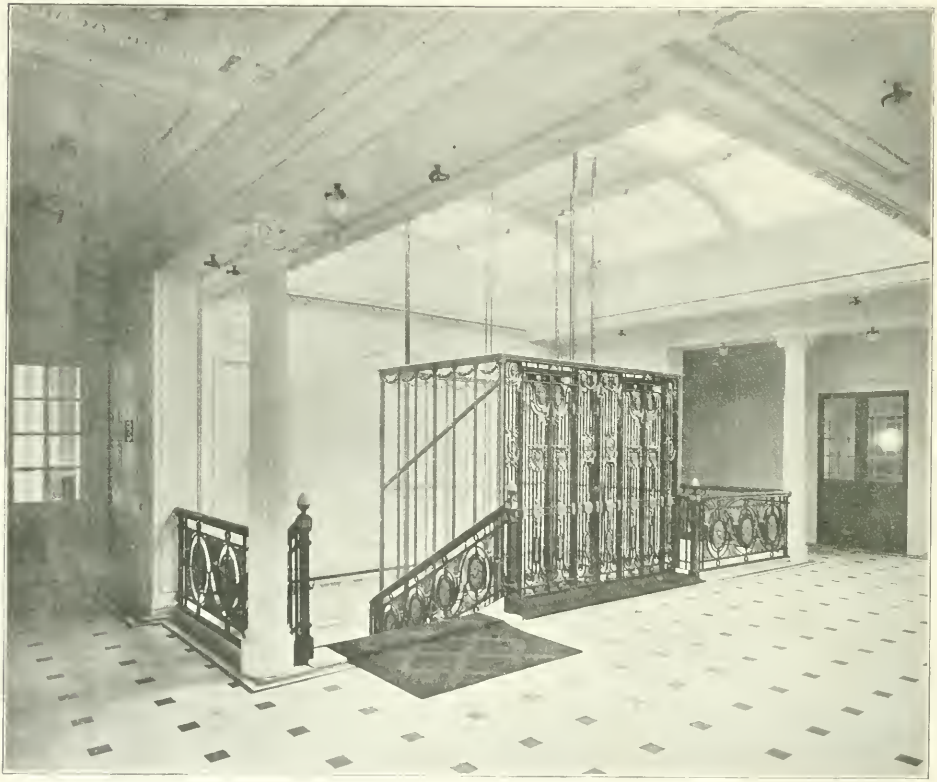
Smoke-Room.

Interior Views of the Cunard Liner "Lusitania."

The Machinery and Boilers.

Steam for all purposes is supplied by an installation of twenty-five cylindrical boilers—twenty-three double-ended and two single-ended—placed in four separate boiler rooms. The forward room (No. 1) contains the two single-ended boilers—which have four furnaces each—and also five double-ended. The other three rooms each contain six double-ended boilers of 17 ft. 6 in. diameter and 22 ft. length. These have eight number—come from the Bedford Works of Messrs. W. H. Allen, Sons & Co.; they are 66 inches in diameter and of the single inlet type. They are driven by sixteen electric motors of 50 brake h.p.

The boilers are placed athwart ship—three abreast—and have side bunkers, save in the case of No. 1 boiler room. Each boiler room has its own elliptical funnel 19 ft. by 26 ft., rising to a height of 130 ft. above the furnace bars.



The Lift, taken from Deck A. The Cunard Liner "Lusitania."

furnaces each making a total of 192 altogether. The double-ended boilers contain 1064 tubes (344 stay tubes and 720 plain tubes). The following are the figures as to heating surface:—

	For each double ended boiler sq. ft.	For the whole installation sq. ft.
Heating Surface..	6593	158,350
Grate area	168·65	4,048

The furnaces are of the cambered type, 4 ft. 2 in. diameter.

Eight of See's patent ash ejectors are fitted for dealing with the ashes. Forced draught on the Howden system is applied. The fans—thirty-two in

The turbine drums are 8 ft. 2 in. long, the h.p. being 11 ft. 8 in. diameter; astern, 8 ft. 8 in.; h.p., 8 ft.; the wheels for the h.p. drums weigh 11 tons 15 cwt., and the blades vary from 22 inches in length down to $2\frac{1}{4}$ inches. As regards the propeller shafting it may be noted that the tail shafts are 22·8 in. diam., whilst the intermediate shafting is 20 inches diam.

There are four main condensers having a total cooling surface of 82,800 sq. ft., and two auxiliary condensers with another 4000 sq. ft.

Messrs. W. H. Allen, Sons & Co. have also supplied the circulating pumps. They are eight in number, arranged in two sets and placed in pairs, each pair

being driven by a separate engine. The pumps are of the "Conqueror" type, the suctions and discharges being 22 inches in diameter. In addition to this main installation there are two auxiliary pumps of 10 in. suction and discharge. Messrs. Weir are responsible for the apparatus to supply feed water. This consists of

	diam	stroke.
4 wet air pumps	40 in.	× 24 in.
4 double dry air pumps	24 ,,	× 7.0 ,,
4 hot well pumps	$14\frac{1}{2}$	× 30 ,,
3 pair feed pumps	$13\frac{1}{2}$	× 30 ,,
3 pair auxiliary feed pumps		
2 surface feed heaters		
2 direct contact heaters ..		

Two feed-water filters, each 36 inches in diameter, are supplied by the Harris Patent Feed-water Filter Co. Messrs. Quiggins, of Liverpool, have provided two sets of distilling machinery, each capable of supplying 10 tons an hour for the boilers under ordinary circumstances, with 150,000 gallons for baths, etc., and 18,000 gallons for drinking and cooking. Amongst other auxiliary machinery may be noticed four boat hoists by Messrs. Lawrence, Scott & Co., of Norwich; four deck cranes of 30 cwt. load (working two at 18 ft. and two at 26 ft. radius), by Messrs. Stothert and Pitt, of Bath; all these are electrically driven. There are four capstans forward and four aft, the power of each set being about 1000 h.p., fitted by Messrs. Napier, of Glasgow. The bower anchors, Mr. Hall's patent, weigh $10\frac{1}{2}$ tons, whilst the cables weigh 125 tons, the length being 330 fathoms and the links $3\frac{3}{4}$ diam.

The Refrigerating Machinery

is divided into two distinct installations, one dealing with cargo and the other with ships' stores. The type adopted is that on the carbonic-anhydride principle, and it is provided by the Liverpool Refrigerating Co., Ltd. Not counting the cold larders, boxes, etc., there are 13,000 sq. ft. of insulated space.

Electric light is supplied by four sets of generating plant, turbine driven. The total number of lights in the ship is said to exceed 6000, and on the trial it may be said that there seemed, if possible, too much light in the corridor and main dining saloon.

Ventilation is a matter upon which much of the health and comfort of passengers and crew alike depend, and no pains seem to have been spared to attain perfection in this respect. Messrs. Lawrence, Scott & Co. have placed sixteen electrically-driven fans in the engine rooms, whilst Messrs. Allens have installed thirty-two in the stoke-holds in connection with the forced draught. The living part of the ship is ventilated on the thermo-tank system. Forty-nine thermo tanks are provided. Of these five are for the crews' quarters, eleven for the third-class, nine for the second and twenty-four for the saloon department.

The *Kitchens* are as remarkable in their way as anything in the ship, that for the saloon extending with the pantries for 126 ft. fore and aft, to the full width of the ship. The main range is said to be the largest in the world. Electricity is here applied to many purposes hitherto left to hand. Plate washing and egg boiling and bread cutting have previously been done by electricity. But here potatoes are peeled, meat is sliced, sandwiches are cut, all by electrical machinery.

The Crew

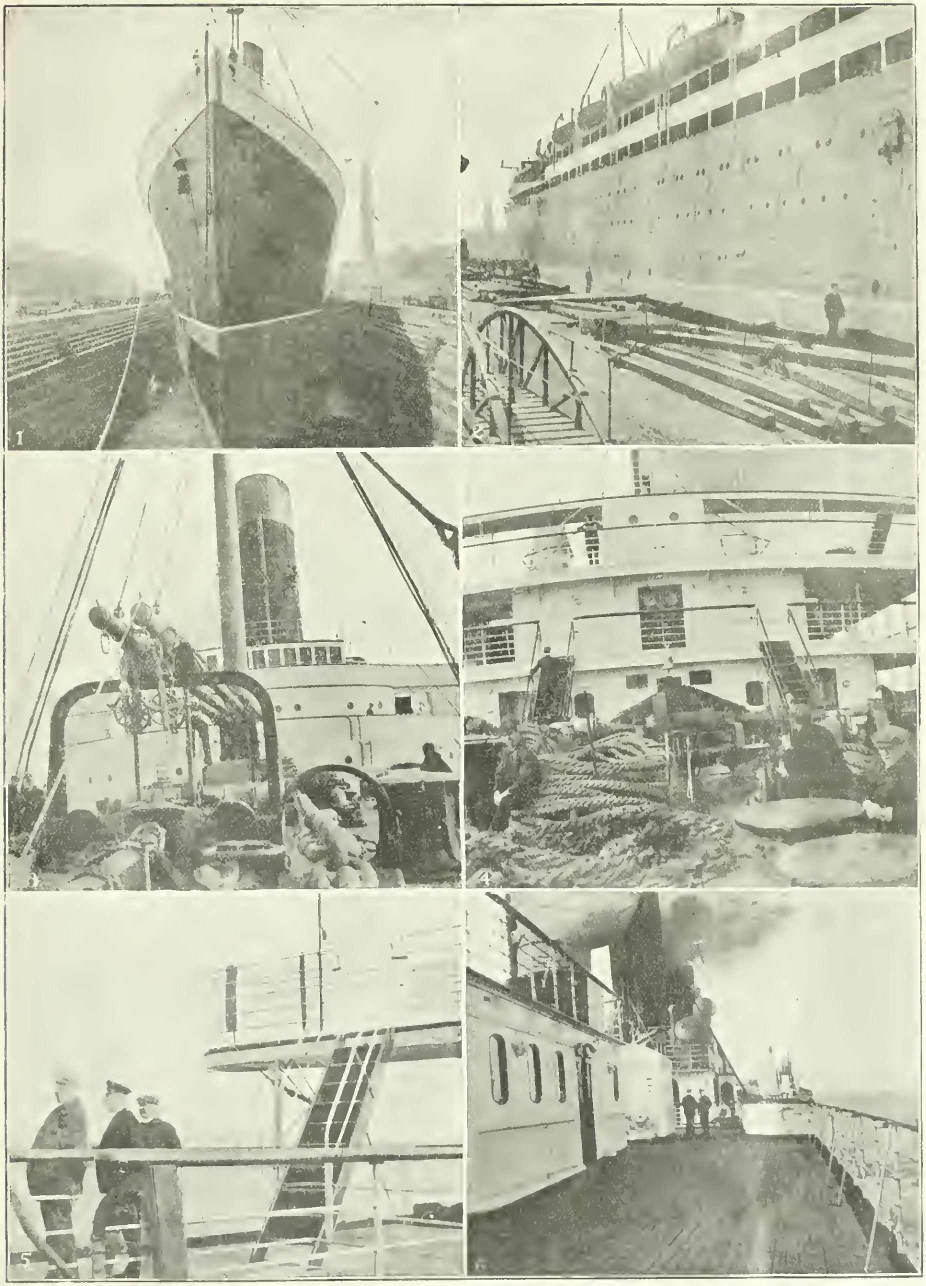
numbers no less than 827 persons, of whom some 369 are under Mr. Alexander Duncan, who has the responsible post of chief engineer of the big ship. His little army comprises 32 officers besides himself, three refrigerating engineers, twenty greasers, 192 firemen and 120 trimmers. The navigating branch seems comparatively small, only totalling sixty-nine persons. Capt. J. B. Watt has eight officers to assist him. There are also eight quarter-masters, and two masters-at-arms, three carpenters, three boatswains, a couple of lamp trimmers, two telegraphists (to work the Marconi installation), and forty seamen. But the biggest branch is that concerned with what may be called the hotel department. It totals 389 persons, including the doctor, three pursers, two lady typists, 2 barbers, seven mail sorters, 29 cooks, 333 stewards and twelve stewardesses.

The Passenger Accommodation.

It is not doing the *Lusitania* full justice to say that the luxury and convenience of her passenger accommodation surpasses that of anything afloat. We may venture to say that it far surpasses anything that the minds of most people connected with passenger vessels could have imagined. One reason for the striking appearance of the vessel is the great height of her 'tween decks and the consequent loftiness of her public rooms. On the main deck and shelter deck there is some 9 ft. of head-room, whilst on the upper deck there is no less than 11 ft. Not only effect but comfort is attained by the feature. It makes the dining saloon, which is situated on the upper deck (D), extend with its gallery and dome to a height of 28 ft. 6 inches. The fact that this huge apartment, capable of seating some 350 persons at separate tables of varying size, can be placed between two of the funnels, seems to our mind to give the best idea of the vastness of the ship. One of our illustrations, shows the effect of the gallery and dome. The dining saloon is painted white, the relief being attained by a considerable amount of gilding. The gallery, of which mention has been made, communicates with the main apartment by a circular opening some 25 ft. in diameter. The difficulty of meeting the fastidious taste of certain wealthy travellers has been attacked by various steamship companies in various ways. The *Lusitania* offers special food at practically all times in the gallery *without extra charge*. Such liberality should solve the difficulty altogether, at least from the passenger's point of view. Outside the dining saloon is the main staircase of the ship, and the two electric lifts which afford ready communication between the five passenger decks (our illustration of the lift is taken from Deck A). In the companion is the inquiry bureau, which fulfils the purpose of the clerk's office in an American hotel. The smoke-room, on the boat deck, is spacious and comfortably fitted its lounges and easy chairs being particularly soothing. The panelling is dark oak. Aft one proceeds to a verandah where it is possible to obtain fresh air under

sheltered conditions. This will certainly be a popular feature of the ship. Forward, round the base of the fourth funnel, are comfortable and semi-private corners which suggest quiet chats over cigars and coffee. These bring us forward to the lounge—really a big drawing-room where men may smoke—or perhaps a smoke-room from which the ladies are not debarred. This is a development of the old idea of sitting in the companion head. But it has grown until the original of the type has been swallowed up in a gracious and attractive room with handsome fireplaces similar in design to, though different in execution from, the smoke-room chimney-piece. Both these rooms have stained glass over a great part of their ceiling area This feature is well shown in our illustrations, where the beauty of the carving comes out with much distinctness. It may be remarked as showing the lavishness and completeness of the work that all this carving is executed in solid mahogany to get perfection of detail, the wood being subsequently painted white The writing-room, still on the same deck, is further forward. The luxury of the two regal suites is very great But the decoration is very dissimilar, the two great artistic firms of Waring's and Trollope's having each been allowed a free hand with one of the suites. Their position has been very carefully chosen. They are situated at the after end of a big deck house which takes up the full width of the promenade deck under the bridge. They are thus not only accessible from within, but have their own egress to retired and sheltered promenades. But it is not only in regal suites or in the numerous state-rooms to which bath-rooms and lavatories adjoin that comfort and luxury is to be found. The arrangement and furnishing of all state-rooms seems to have had the anxious solicitude of practical persons. Not only are new type washing basins, hanging wardrobes, chests of drawers, sofas and such like provided. There are little details on which a great deal of comfort depends that have been carefully studied. Bell pushes and electric light switches are conveniently

The Lounge. The Cunard Liner, "Lusitania."



The Cunard Liner "Lusitania."

placed. Clothes hooks are numerous, and the arrangements for fixing the doors ajar for ventilation are completed by the introduction of a rubber-buffered spring hook which prevents rattle and sound.

The accommodation of the second and third-class passengers is relatively quite as sumptuous as that of their more highly-paying fellow-travellers. Some of the third-class berths are placed in pockets, which can alternatively be used for passenger accommodation and for cargo purposes. These are approached by staircases which can be closed by water-tight doors from above. One little point here is noticeable. At ordinary times the doors are thrown back and padlocked to the bulk-head. The key of the padlock hangs in a little case near by. Should it be necessary to close the door, the taking down of the key starts a bell ringing below and this warns those in the pocket to come out ere the door be closed; nothing that can relate to comfort or safety seems to have been forgotten.

In the "Fleets of the Mail Lines" for August, the dry docking of the *Lusitania* at Liverpool was mentioned. Nos. 1 and 2 of the smaller illustrations were taken at that time. The first of these snaps gives an idea of the liner, whilst the other, taken before the water was let down, gives some idea of her huge bulk. The operation being successfully accomplished, the big ship returned to the Clyde, where, on the 27th July, she embarked a large contingent of guests for her trial trip. Leaving the Clyde about 9 p.m. on the Saturday night she went away at three-quarter speed—say 22 knots—and so into the Atlantic. There was no intention to press her on this part of the cruise, and she maintained the desired rate of progress with reduced boiler power and remarkable steadiness and freedom from vibration in what was really a heavy Atlantic swell off the West Coast of Ireland.

In the course of Sunday there was opportunity to take a few more pictures. No. 3 is taken from the eyes of the ship, and shows a view of the huge cables—the largest ever constructed—and at the same time gives an idea of the immense strength of the forward part of the tiers of deck-houses, which form a solid series of steel breakwaters rising one above the other. No. 4 is taken from far aft and suggests the height of these houses better, perhaps, than does the view from forward. No. 5 shows two of the more distinguished—from a shipping point of view—of the builders' and owners' guests. The foremost of the three in the party is Mr. Arthur Bibby of the Bibby Line and of the Pacific Steam Navigation Company, one of Liverpool's most distinguished business men. Behind him stands Sir William White, K.C.B., formerly Chief Constructor of the Navy and one who is keenly interested in the new ships and their performances. No. 6 is a deck view.

At 10 o'clock on the Monday morning, the *Lusitania*, having passed Queenstown the previous evening, was off the Mersey bar. For several reasons it was not desired to take her into the river, and so the Cunard Co.'s tender *Skirmisher* came down and took off the invited guests—some of the ladies amongst whom found the tender by no means as steady a resting-place, even in Liverpool Bay, as the steamship had proved in the open Atlantic. As soon as the guests were disembarked, the big Cunarder turned seaward and was off again for further trials. The test now entered upon was one at 37,000 tons displacement with a draught of 32 ft. 9, that is to say, under normal Atlantic conditions. She proceeded first to Corsewell Lightship, off Loch Ryan. Thence she started at midnight, and ran to the Longships, passing down the Irish Sea and the Bristol Channel. The course is 303 miles. She ran it in something under 12 hours, the speed being 26·4 knots. Turning, another twelve hours found her off the mouth of the Clyde, having maintained on the northward run a speed of 24·3 knots in the face of half a gale of wind. Noon of Wednesday saw her again at the Land's End, the second southward run having been accomplished within two minutes of the time she had previously taken in covering it. Her fourth journey over the course was made at a speed of 24·6 knots, so that the mean maintained for the whole 1,200 miles traversed was 25·4 knots. On the Thursday she was again tested, this time over a 59 miles course between the Corsewell Light and the Chicken Rock. Out and home over this she averaged 26·45 knots. Her trials up to this time had covered a good deal over 2,000 miles, and it was stated that the horse-power developed varied between 62,000 and 68,000 i.h.p., though it has been stated in print that at one time she was making 78,000 i.h.p. An interesting statement to convey what 68,000 h.p. really means was made on board the ship. Sixty-eight thousand horses, if ranged twenty-four abreast—which is about as many as could be got into a London roadway—would extend from Somerset House in the Strand to the Earl's Court Exhibition. In single file they would reach from London to the Isle of Wight!

It should be mentioned that, for purposes of war, the *Lusitania* is fitted to carry twelve six inch quick-firing guns. Sheltered positions have been chosen for these weapons, which have a penetrating force of equal to penetrating six inches of armour at 3000 yards' range.

Steam Navigation.—One hundred years ago on August 19th, Fulton ran his trial trip with the *Clermont* at the rate of about five miles an hour. In celebration of this centenary an exhibition was held on the Continent and a series of lectures were delivered, in the course of which all the interesting and notable details connected with the introduction of steam navigation were touched upon. Blasco de Garay, with paddle wheels driven by manual labour at Barcelona in 1543; Papin with his experiments by steam power in 1707; John Fitch, Jas. Rumsey Patrick Miller, Taylor and Symington; John Stevens, Jonathan Hulls, Robert Fulton, Henry Bell and Jas. Watt are names which arise before us as we consider the initiation of what is now an industry, the proportions and the productions of which are so immense.

Seamen for the Swedish Navy are trained for their work and receive their technical training in training brigs, three of which paid a visit to the Port of Leith in the course of the month of August. The trim appearance of the vessels, which are painted white, called for and received the admiring attention of many witnesses. The youngsters with their training staff visited Edinburgh and its sights during the stay of the ships in dock and the Corporation extended to the officers and crews the rites of hospitality, a pleasing feature in connection with their visit which was doubtless much appreciated. Following on the visit of the Swedes, came a Danish training vessel, then a German war ship, the crews of these also partook of the hospitable welcome of the Scottish capital. Such visits tend greatly to the establishment of peace and goodwill among the nations of the earth.

NAVAL MATTERS PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

The launch of the *Bellerophon* on July 27th was successful in every way. The arrangements were carried out without a hitch, the weather was favourable, the attendance of spectators large—about 30,000—and the naming ceremony was performed by a Princess. The vessel went off in splendid style, and Princess Henry appeared well pleased with the success of the whole affair. At the luncheon in the Mould Loft there were no speeches, but Admiral Robinson thanked the Princess for attending the ceremony. There was no parsimony on the part of the Admiralty in the matter of the cost of the launch, as it was expected there would be after the recent order. The *Bellerophon* is to be pushed on vigorously, so that she may be completed well within the two years. An important alteration in connection with the 12-inch guns is to be carried out. The foremost of the two barbettes astern is to be raised so as to enable its guns to have a clear fire astern. The guns in the *Dreadnought's* after barbette cannot do so, as they are masked by the barbette further aft. The *Dreadnought* was placed in dock on August 15th to have a new system of steering gear fitted, and this, if it proves successful, will be introduced into the *Bellerophon* and the other vessels of the class. It is now stated that our new battleship is to be laid down in November, and two others elsewhere, all of them to be completed within two years of the commencement. They will be heavier than the vessels now building, and will probably carry a more powerful primary and anti-torpedo armament—indeed, 13-inch guns are spoken of. The *Bellerophon* had been placed in the large basin, but owing to the limited accommodation she had to be undocked before the *Dreadnought* could be docked. Good progress is, however, being made with her. The site for the new dock has now being definitely chosen, and it is to be cut through between the tidal basin and the large ship basins on the north side of the north and south locks and parallel to them. It will be 861 feet long, 121 feet wide and 50 feet deep, and it is estimated to cost a million sterling. In connection with the *Bellerophon* all here feel that the King has paid a compliment to the yard by conferring a knighthood on the manager of the Constructive Department, Mr. Thomas Mitchell. Sir Thomas leaves us on September 1st, his successor being Mr. John Apsey, chief constructor at Malta. The Royal review at Cowes on August 3rd was a grand spectacle, nearly three hundred pennants flying. Never before has such a fleet been gathered together under the command of one admiral. The King's message is worth quoting: "His Majesty is greatly pleased with the efficient condition of the Home Fleet, and is very glad to have had the opportunity of inspecting it in such glorious weather." The King's belief in the efficiency of the Home Fleet must have received further confirmation from the unparalleled feat of marksmanship which he witnessed on board the *Dreadnought* two days later. His Majesty was so pleased that he decorated the gunnery lieutenant and the gun layers with the Royal Victorian Order. The operations preceding and following the review were decidedly unfortunate to our destroyers, for out of thirteen half of them came to grief. The *Waveney* and *Garry* collided off Sandown on the night of July 26, both being damaged. The *Kestrel* and *Teviot* collided off Swanage on August 7th, the former having her bows cut completely away. The *Cynthia* lost her rudder and had to be towed back to port, and the *Coquette's* air compressors broke down, so that she could not charge her torpedoes. The *Quail*, of the Nore flotilla, is also here. She was in collision with the scout *Attentive* on the night of August 6th, and had her bows cut away almost as far back as the fore gun platform. The *Rother*, also of the Nore flotilla, arrived on the night of July 26th and reported having been run into off Beachy Head by a steamer which struck her on the port bow and made a large hole from the upper deck almost down to the water line. The most serious mishap, however, inasmuch as it caused the loss of life, occurred in the *Spiteful* on August 5th, two men being killed and two injured. The vessel is fitted to burn oil and has for some time past been carrying out experiments in connection with that fuel. She was getting up steam when, through a leak in one of the sprayers, the oil fuel caught fire enveloping, the stoke hold in flames. The question of docking accommodation has been brought prominently to the fore in connection with these mishaps. On the *Kestrel's* arrival all the docks were occupied, the *Quail* having been put in the deep dock. The small dock near the King's Stairs had, therefore, to be utilized for the *Kestrel*, but if part of her bows had not been cut away she could not have been got into it. The *Warrior*, of the Fifth Cruiser Squadron, arrived on August 6th for certain fittings to be completed, and the cruiser *Spartiate*, of the Home Fleet, is also to be refitted.

Chatham Dockyard.

The official reply which Mr. Ernest Lamb, M.P., has received from Mr. Robertson, on behalf of the Admiralty, to the representations recently made to him by the mayors of Chatham, Rochester and Gillingham, states that the idea that Rosyth is being created as a rival to Chatham is incorrect. The development of Rosyth is entirely independent of Chatham and has no bearing on the latter's future. The difficulty of access to Chatham makes that port unsuitable for a modern naval base, having regard to the enormous increase in the size of the latest battleships and cruisers. The reply has naturally caused a feeling of great disappointment amongst all sections of the community. It was expected from the sympathetic hearing which was accorded to the mayors of the three corporations that Chatham would be restored to the position it formerly held as a shipbuilding establishment, but this consummation now appears as far off as ever. And it looks as if we shall have to rely mainly on repair work. The Financial Secretary sounded a note of warning when he said: "I cannot disguise the fact that with the increase in the number of vessels whose dimensions make it impossible to repair them at Chatham the provision of work for an establishment on the present scale will become more and more difficult." So unless the policy of the Admiralty undergoes a change the outlook for the district must be regarded as gloomy. Chatham has been in a state of siege, and the operations which were carried out for miles around the town aroused great interest. All the forts in the neighbourhood were manned by troops and extensive mining and counter-mining works were carried out, the operations being witnessed by some distinguished visitors, including the Secretary of State for War. The *Magnificent* has come here to have alterations made to enable her to utilize oil fuel. The battleship, it is interesting to note, was built at this yard, and when commissioned in a week under two years from the date of the laying of her first keel plate it was thought that the high water mark in rapid construction had been reached. Our record has now been quite eclipsed by Devonport and Portsmouth, but our staff have not been given opportunities recently of showing what they can do in that direction—and probably now never will. The *Magnificent* served for about ten years in the Channel Squadron and afterwards in the Atlantic Fleet. She joined the Sheerness-Chatham Reserve Division (now the Home Fleet) in November last. The battleship *Swiftsure*, of the Channel Fleet, has arrived for a refit, as has also the *Sutlej*, of the Fourth Cruiser Squadron. The cruiser *Thetis*, which has been fitted for service as a mine layer, was commissioned on August 1st by Captain Chatterton for service in the Nore Division of the Home Fleet. The *Iphigenie*, which was commanded by Captain Chatterton and temporarily attached to Chatham while being fitted as a mine layer, has resumed duties in the Portsmouth Division of the Home Fleet. Another vessel from Portsmouth, the cruiser *Latona* has arrived to be similarly fitted. The cruiser *Medusa* has been moved to Sheerness and placed in the sale list. Her Dürr water-tube boilers, which were specially fitted for special trials, have been taken out and will be fitted in the special service ship *Vulcan*, which is to undergo extensive repairs for service as a seagoing depot ship for destroyers. Talking of destroyers reminds me that we have not many of those craft here just at present, most of them having left on August 20th for a three weeks' cruise in the North Sea. The *Recruit*, of the Fourth Flotilla, which was damaged through a barge striking her bows whilst at anchor in the Medway, has been put right,

and she left the same day to join the flotilla at St. Andrew's. All at Chatham were pleased to hear of the honour conferred by the King on Mr. Mitchell at Portsmouth the other day, for Sir Thomas Mitchell (as he now is) is one of our boys, having received his education at this yard.

Sheerness Dockyard.

Most of the ships of the Home Fleet are now back at their moorings and the harbour presents a busy appearance. August 8th was an active day, no fewer than sixty vessels, ranging from battleships to torpedo boats, arriving in port. The destroyers and torpedo boats went on to Chatham to prepare for another cruise. There was, however, a splendid array of vessels left for the Coronation Day celebration next day, the harbour, with the ships dressed rainbow fashion, presenting quite a gay appearance. The flagship *Leviathan*, of the Fifth Cruiser Squadron, and the battleship *London*, of the Home Fleet, did not return until a week later, as they went to Berehaven to calibrate, while the *Warrior*, after the review, went to Portsmouth for some work to be completed. An interesting ceremony took place in the Solent the day before the Royal review, when Lord Dundonald presented to the cruiser *Cochrane* a shield and a portrait of the famous Lord Cochrane, after whom the vessel is named, as a gift from the Cochrane family, of which Lord Dundonald is the head. Another vessel of the Fifth Cruiser Squadron—the *Duke of Edinburgh*—will leave at the beginning of September to join the First Cruiser Squadron attached to the Channel Fleet, which is to be increased from four to six vessels. The *Duke of Edinburgh* and her sister vessel, the *Natal*, were detailed as an escort to the Royal yacht *Victoria and Albert* when the King embarked at Port Victoria for Flushing *en route* to the Continent on August 13th. The two active service destroyer flotillas came into port on the 8th with the exception of the *Quail*, which was badly damaged in a collision with the scout *Attentive* off Portland the previous day, and went on to Portsmouth. She will not be able to resume duties for some months. The *Rother*, one of our nucleus crew destroyers, is also at Portsmouth, having been run into by a steamer off Beachy Head on July 26. Five destroyers,—the *Welland*, *Wear*, *Success*, *Ettrick* and *Seal*—came into dockyard hands to refit, but most of them have now been put right. The scout *Adventure* with the two flotillas went to sea on August 15 for a three weeks' cruise in the North Sea. No. 5 Dock, which has lately been extended, is occupied for the first time by a modern destroyer, the *Welland*, one of the river class, having been placed in it. The work of the yard has been very much hampered during the past two years, but now the five docks are available we have accommodation if necessary for eight destroyers. Five of the six submarines of the newly-formed Nore flotilla, with the parent ship *Thames*, left the Medway on July 29th on a cruise along the East Coast, calling at Yarmouth and other ports, and also visiting the Firth of Forth. The cruise, which is expected to last until the end of August, is the first which has been taken by the flotilla since its arrival here. Submarine C6, which has been in No. 4 Dock, was passed out of dockyard hands on August 20th. It is expected that with the docking of each submarine every six months a considerable demand will be made by the flotilla upon this particular dock. The sloop *Wildfire* has been taken in hand for a refit, and the conversion of the sloops *Rinaldo* and *Vestal* into gunnery tenders is proceeding. The latter has been dismantled, and both vessels are to undergo considerable alterations to fit them for their new duties.

Devonport Dockyard.

The launch of the battleship *Téméraire* on August 24 passed off successfully, the naming ceremony being performed by Countess Fortescue, the wife of the Lord Lieutenant of the county of Devon. The vessel was launched without her rudder, this being I believe the first time that a ship has been so launched at this yard. Neither were the propeller shafts fitted so that these fittings will all have to be executed in dock and therefore the ship will be in dock somewhat longer than usual. Her launching weight was over 7,000 tons. No time will be lost in completing the vessel and eighteen of her water tube Yarrow boilers manufactured by Messrs. Hawthorne & Co. were here ready to be placed on board immediately the battleship was afloat. It was expected early in the year that the new cruiser *Minotaur* would be ready for the pennant by October, but it does not now appear likely that she will be. She was undocked at the end of July at the North Yard and removed to No. 1 Jetty at the South Yard, where the gun houses for two 7·5 inch guns were hoisted on board. These complete the 7·5 inch armament, the two 9·2 inch guns and fittings being expected at the end of August. The *Minotaur* will be one of the finest cruisers ever built at this yard, and it is expected that when she is first commissioned it will be as the flagship of Rear-Admiral Sir Percy Scott. The cruiser *Talbot*, of the Channel Fleet, has been docked for a refit, and the battleship *Cæsar*, of our local division of the Home Fleet, is also to have a very extensive refit. All her boilers are to be re-tubed, and it will take three or four months to complete the work in the engineering manager's department. In the constructive manager's department there is also a great deal to be done before the vessel will be ready for sea. The cruiser *Cumberland*, which has been fitting out as a seagoing training ship for cadets, is to be completed by September 3. We have not had many mishaps in connection with the mobilization of the Home Fleet. The destroyer *Gipsy* met with an accident which might have proved serious. When engaged in a night attack with the destroyer flotilla, steaming at 26 knots an hour, it was discovered that the crank shaft on the port side was split and if the speed had been continued it would have probably resulted in the snapping of the propeller shaft. The port engine was stopped and the vessel, accompanied by the *Leopard*, proceeded to Queensferry and subsequently steamed to Devonport with her starboard engine. The damage will take about three mouths to repair. The widening of the floor of No. 7 Dock at the North Yard is so far advanced that destroyers of the larger types can now be docked in groups of three instead of pairs as formerly, one vessel being taken in stern first and the other two in the ordinary way. The port's docking accommodation for this type of vessel has now been increased fifty per cent. The four "B" submarines have been in No. 5 Dock at the North Yard undergoing a thorough overhaul. It was not of a very extensive nature, as defects are dealt with by the staff and fittings of the parent ship, the vessels thus being maintained in a high state of efficiency. They must, however, be docked occasionally, and as the operation was not completed in time they did not take part in the Royal Review at Cowes. The work of salving Torpedo Boat No. 99, which was lost off Berry Head three months ago, has been going on under the direction of Commander Gilpin-Brown assistant to the captain of the dockyard, and the boat was successfully raised and beached on August 25, preparatory to being brought to this port. The expeditious manner in which a cargo of oil brought by the tank vessel *Osceola* was recently transhipped to the storage tanks in the South Yard deserves to be noted, her cargo of over 50,000 gallons of oil being transferred by means of flexible piping to the storage tanks in less than six working hours without the slightest leakage. This is a striking contrast to the old system, by which oil was transhipped in casks, the process occupying days and, in some cases, weeks.

Pembroke Dockyard.

The construction of the *Boadicea* is proceeding satisfactorily, although scarcity of material is said to still somewhat impede progress. The funnels of the *Defence* have been the subject of considerable remark, being much shorter than those fitted in any previous ship here. They have attracted particular attention, as in the last vessels of the *Monmouth* class, tall funnels were the rule. In the *Andromeda* and her sisters, the funnels almost reached the level of the platforms on the standing masts, but in the *Duke of Edinburgh* and the *Warrior* they were shortened a little. The still greater reduction in the *Defence* has, it is understood, been rendered practicable in consequence of the installation of an extensive system of fans for the purpose of supplementing the natural draught in the boilers. The low funnels appear likely to have one disadvantage, as their tops will be almost on a level with the navigating bridge, and this will render the occupants liable to some inconvenience and discomfort, especially when oil fuel is used or when the vessel is steaming against the wind. Two of the four funnels have been fitted. As the *Defence* is not to be completed before December of next year, her steam trials will not be carried out before March. It

was expected that the vessel would have been expedited in consequence of the recent order as to the docking of ships twice within the twelve months following the date of their launch, but an exception is to be made in the case of the *Defence*, examinations of the plating of the bottom by divers having been approved instead of docking. When the *Defence* is carrying out her steam trials, the *Boadicea* will be berthed under the crane at the Carr Jetty to receive her machinery and boilers. Messrs. Scott & Co. are making good progress with the engines and boilers of the *Defence*, all the latter now being in place. Mr. H. Pledge, the newly-appointed chief constructor, was expected to enter upon his duties early in September, but he has been given an extension of leave until the 23rd of that month. Mr. A. M. Worthington, the assistant constructor, who is now doing duty as chief constructor, will be promoted to constructor on September 2nd. He should have taken up an appointment at the Admiralty on September 16th, but he will remain until Mr. Pledge's arrival. The vacancy caused by Mr. Worthington's departure will be filled by Mr. J. Rogers, assistant constructor, now at Chatham, who, it is interesting to note, served his apprenticeship here.

THE "HAY" BOILER.

We have much pleasure in giving to our readers a description and illustration of the "Hay" boiler. It is claimed by the makers that it is lighter in weight, occupies less space, and has a larger proportion of heating surface to grate surface

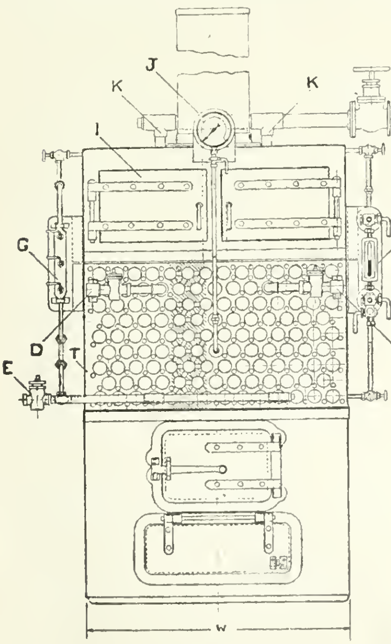


Fig. 1.

than other boilers. Further, it is very economical, due to the combination with the boiler of a feed-water heater and superheater. While being a quick steam-raiser, and capable of standing rough usage and forced

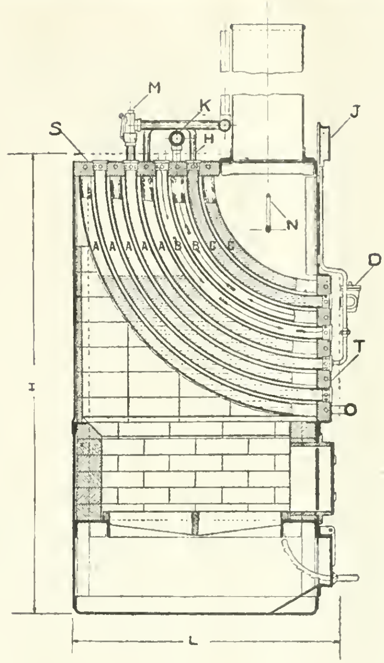


Fig. 2

draught, it cannot be damaged by running short of water. It can be easily and cheaply repaired, for the reason that any tube can be removed and replaced from the outside of the boiler without disturbing other tubes; and should a tube give out, it can be plugged without drawing the fire.

We illustrate in the adjoining diagrams one of the Marine type D, particularly suitable for steam launches, steam flats, tug boats and similar crafts,

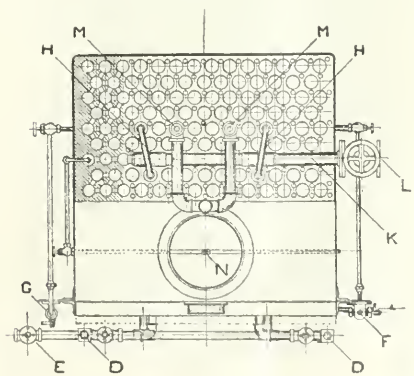


Fig. 3.

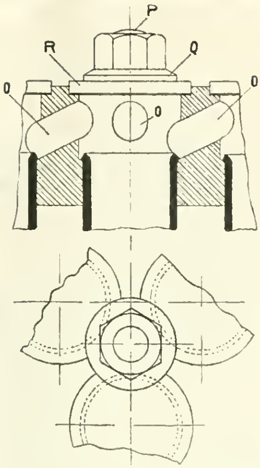


Fig. 4.

made by the "Hay" Boiler and Engineering Company, Limited, of Birkenhead. Fig. 1 is an outside elevation, from which the position of the various fittings can be seen. Fig. 2 is a transverse vertical section. Fig. 3 is a plan of the top of the boiler. Fig. 4 is a part sectional view of the headers, the arrangement of the communicating holes and covers being shown in detail. The boiler shown consists of nine layers of tubes, of which five are steam tubes **A**, two are drying and superheating tubes **B**, and two are feed-water heating tubes **C**. These tubes are supported at their ends in a top header **S** and bottom header **T**, and communication between the tubes **A** with one another is effected by holes **O** drilled from one tube hole to another. The tube holes are closed by covers **R**, convex washers **Q**, and studs and nuts **P**, each stud and washer bearlng on three covers.

The feed water enters the boiler through the feed check valve **D**, passes up the two feed heating pipes **C** by the external pipes **H** into the steam tubes **A**. The steam generated passes from the steam tubes **A** into the superheating tubes **B**, and thence to the steam-collecting tube **K**. The usual fittings, such as safety valves **M**, water gauge **F**, water column and test cocks **G**, cleaning doors **I**, pressure gauge **J**, stop valve **L** and steam jet **N**, are arranged as indicated.

The boiler, as illustrated in Fig. 5, has 245 square feet of heating surface, and eight square feet of grate area, a height of 6 ft. 6 in., width 3 ft. 8 in., and length 3 ft. 10 in. Its weight, when empty, is 2 tons 10 cwt., and, including water, 2 tons 12 cwt. 2 qrs. The tubes are two inches in diameter, $\frac{5}{32}$ inch thick, and 122 in number. The working pressure is 200 lbs. per square inch, and the evaporative capacity is 1,225 lbs. of water per hour under natural draught, and 2,450 lbs. under forced draught.

In order to test the fact that the boiler is absolutely fool-proof, the makers have emptied a boiler they have for demonstration purposes at their works, over sixty times and re-filled it with cold water while a good fire has been burning in the furnace without any detrimental result. We await with interest the development of this type of boiler, and evidence of its working under the usual conditions of service.

SOME PRACTICAL POINTS IN THE APPLICATION OF THE MARINE STEAM TURBINE.

By the Hon. C. A. Parsons, C.B., F.R.S. (Member of Council), and H. Wheatley Ridsdale, Esq. (Member).

(Continued from page 12.)

In the year 1877 a committee, consisting of Lord Kelvin, Mr. W. Froude, Mr. James Napier and Professor Osborne Reynolds, was appointed to study the behaviour of screw steamers when reversing the engines, and it was demonstrated in their report that "full speed astern" may often bring about a collision, whereas by steaming ahead and using the rudder, it might be avoided.

As an instance, the turbine steamer *Viking*, 350 ft. B.P., and with a displacement of some 2500 tons, when steaming ahead at 20 knots was found to have a turning circle 1,475 ft. in diameter, or about 4·2 lengths of the ship. Such a ship would require about 2½ lengths to stop in when reversing the engines and maintaining the course. It is therefore evident that the ship's head could be turned through 90° by combined use of rudder and engines in much less distance than 2·5 lengths.

The following figures may also be compared.

* Read at the Bordeaux International Congress and Summer Meetings of the Forty-eighth Session of the Institution of Naval Architects, June 25, 1907.

COMPARISON OF TURNING CIRCLES AND DISTANCE REQUIRED TO STOP FROM HIGH SPEED.

Ship and Type.	Full ahead speed.	Speed ahead from which trial made.	Diameter of turning circle.	Distance run before stopping from speed in column 3.		Time elapsed.		Full astern speed.
	Knots	Knots	Feet	Feet	Lengths	M.	S.	
Turbine S.S. *Viking*, Channel screw steamer	23·5	20	1475	—	—	1	45†	—
Turbine S.S. *Princesse Elisabeth*, ditto	24	20	—	690	2·0	1	26	16
Turbine S.S. *Queen* ditto	21·75	19	—	780	2·5	1	7	12
Turbine S.S. *Lübeck*,* small cruiser	23	22	—	1530	4·5	1	45	—
Turbine S.S. Destroyer..	28	27	900	715	3·6	0	38	16
Reciprocating S.S. *Nebraska*, battleship......	—	19	1050	—	—		—	—
Reciprocating S.S. *Indiana*, battleship	—	14·5	—	1080	3·0		—	—

*The figures for the *Lubeck* are given on authority of the *Marine Rundschau*, December, 1906.

†This trial was made from full speed ahead.

Data as to combined use of helm and engines show even superior results. For instance, the Calais and Dover steamers turn completely round, and change from steerage headway to steerage stern-way in under two minutes.

Reversing turbines have been fitted from time to time of such power as the conditions of service demanded. In recent turbine installations the revolutions astern attained at the moment of stopping the headway have been from 65 per cent. to 80 per cent. of full ahead revolutions in the case of ordinary three-shaft turbine steamers. Installations with four shafts have had astern turbines fitted to all shafts, the arrangement consisting of two turbines in series on each side of the vessel. The number of such installations is still too small to enable us to make reliable comparisons as to results.

The question of speed under stern-way may be very lightly touched upon, because if sufficient stopping power be given to the ship, she will be sure to run astern much faster than is required for practical purposes. At least two turbine vessels have exceeded 16 knots under stern-way, *viz.*, the German destroyer S125 and the Ostend-Dover service steamer *Princesse Elizabeth*, in the latter case the speed astern being as high as 68 per cent of that reached ahead. Much depends upon the suitability of the stern lines for temporary use as a "bow."

Reversing turbines originated with the one row of reversing blades used in the single radial flow turbine first fitted to the *Turbinia* (1894), which exhausted, as in present practice, direct to the condenser by the same passage as the ahead working blades (Fig. 1). In the *Viper* and *Cobra* the reversing turbines were independent, but in the next vessels, *King Edward* and *Velox*, the form now universally used in Parsons turbines was adopted, a parallel flow turbine being used, mounted on a prolongation of the main low-pressure ahead spindle and situated in the exhaust chamber (Fig. 2). In four-shaft vessels with reversing turbines in series, the high-pressure reverser is built as an independent turbine (as in *Viper* and *Cobra*), while the low-pressure reverser is of the ordinary type as above described.

It might be thought that powerful reversing turbines would be desirable to enable the ahead rotation of the engines to be very speedily checked and reversed. As a matter of fact this does not appear to be necessary, because so long as the reversing turbine is revolving against the contrary flow of steam, the effective steam pressure on its blades is very considerably greater than when running normally, thus forming an extremely powerful brake.

The amount of torque developed on the shafts is, of course, a matter of small importance, provided the full surface of the propellers be utilized. It was found in one case that the power measured by torsion meters during a continuous run astern varied from 20 to 25 per cent. of full power ahead, while the maximum torque measured, while reversing and stopping the ship, gave as much as 35 per cent. of ahead power. This was in a vessel having an installation of reversing turbines of not quite the most favourable description. Even thus, however, the direction of rotation of the shafts was changed in about twelve seconds from receiving the order, and the reversing turbines were sufficiently powerful to cause cavitation by the propellers up to the time the ship's way was stopped—evidently the limit of useful effect.

The relation of speed in rough water compared with that in smooth of a turbine vessel is of considerable importance, and there is a difference in this respect between different types of ships.

The vessels which lose most speed in disturbed water are those propelled by paddle wheels, and this is especially so with a beam sea. Screw-propelled reciprocating vessels are most affected by the racing of the propellers. In turbine-propelled vessels, on the other hand, the screws, owing to their small diameter and great depth of immersion, never race, and full steam can be maintained in all states of the sea with absolute safety to the machinery. That the revolutions are very little increased, even in exceedingly rough water, is proved by the fact that no case has yet been recorded of the safety cut-out being brought into action in any vessel on service, although it is usually set to cut off steam should the full speed revolutions be exceeded by from 5 to 10 per cent. These facts apply to all turbine vessels.

Cases are known of torpedo boats and destroyers having been run up to normal full power in very heavy weather with entire freedom from accident, the limiting factor of speed under such conditions coming from the bridge, due to considerations of safety of the vessel, and not from the engine room. The earliest demonstration of this quality in light high-powered turbine craft was given by the *Turbinia* in 1897.

Several cases might be cited in illustration of what can be attained in actual practice with Channel steamers, but we may instance the trip of the *Princesse Elizabeth* in the winter of 1905-6, when she performed the 60-mile run between Dover and Ostend at an average speed through the water of 22 knots, in weather officially described as a moderate gale, *i.e.*, wind force 7 to 8, or about 25 knots. This for a vessel 344 ft. long, and drawing only 10 ft. of water, speaks for itself. Ships of fuller form with the bows above the water-line flared out to an extreme amount, encounter in a head sea an augmented hull resistance proportionately greater than the classes of vessels just spoken of.

The intermediate type of ship with turbine machinery may, under special circumstances, fall off slightly more in speed than when fitted with reciprocating machinery when the pitching is sufficiently severe to cause largely augmented hull resistance *without* being sufficient to necessitate easing the reciprocating engines on account of racing, but in all conditions of weather over the length of the voyage, it is very questionable whether even in this class of vessel the turbine boat is not equal or superior in this respect to the ordinary reciprocating engine vessel.

The express type of liner with turbine machinery will probably be at an advantage over that with reciprocating engines in all conditions of wind and sea, just as her smaller prototype, the Channel steamer, is. Pitching of this type augments the hull resistance but inconsiderably, but the propellers of reciprocating engines are very much more liable to race in this class of vessel.

Warships (other than destroyers already mentioned) naturally follow the same principles. Experience has already shown that small cruisers and vessels of the small scout type with turbine machinery compare very favourably in this respect with their reciprocating sisters. A small turbine cruiser of only 340 ft. length has run a 24 hours trial at 20 knots in open water with wind force up to 7, which speed could only with great difficulty and some danger to the machinery be maintained by a similar vessel with reciprocating engines.

As regards turbine battleships, the reported performances of the only existing example to-day, the *Dreadnought*, point to the absence of any difficulty or abnormal loss of speed in bad weather.

This paper being addressed in greater measure to those who have not yet had practical experience of the application of turbines to marine propulsion, we may be excused for referring to one or two practical points in connection with coal consumption. Shipowners and Admiralties naturally ask for comparative figures, and if these comparative figures are based purely on *trial trip results*, no one will be surprised to be told that the turbine is not always in all ships and at all speeds more economical than the best records of the reciprocating

engine. The extended use of steam turbines, and the comparisons which have been instituted between service records of the two types of machinery, have demonstrated the unreliability of proceeding merely on trial trip records as a basis.

We think it may be taken as proved (without citing at length the numerous careful tests) that the steam consumption of any given turbine of the Parsons type is constant over a life at least as long as that of the oldest examples now running

We have heard it stated that in high speed liners (for instance), where the reciprocating engines are very well maintained, the wear of rubbing surfaces and other contributing causes to the growth of steam consumption are provided against by the efficient supervision and careful overhauls which these vessels receive in port after every trip. No doubt there is a great deal in this argument, but against it there is the fact that such maintenance is necessarily expensive.

Ordinary ships are more often run until the engines require a thorough overhaul, when either the coal bill will have increased or the speed will have fallen off to a marked extent. In either case any *initial* economy over the turbine would appear not to be maintained on actual service conditions.

Another objection is urged by the advocates of reciprocating engines for warships, namely, that, at least in some navies, these engines are not required to perform sufficient service for wear and tear to influence their efficiency seriously

SERVICE COAL CONSUMPTIONS OF TURBINE AND RECIPROCATING ENGINED SISTER CRUISERS.

	1st Comparison.		2nd Comparison.	
	Turbine Cruiser.	Reciprocating Cruiser.	Turbine Cruiser.	Reciprocating Cruiser.
Duration of comparison	92 hours	92 hours	132 hours	132 hours
Distance run	1380 sea miles	1380 sea miles.	2090 sea miles	2090 sea miles
Total coal consumed ..	245 tons	297 tons	366 tons	416 tons
Approximate mean speed	15 knots	15 knots	15 8 knots	15·8 knots
Excess consumption of reciprocating engines	52 tons		50 tons	
Ditto, per cent.........	21 per cent.		13 7 per cent.	

It should be noted that the turbine cruiser had been in service two years and the reciprocating engine cruiser two and three-quarter years Respective figures for the destroyer are two and a half years and three years

Fig 1

Diagram arrangement of reversing turbine 1894

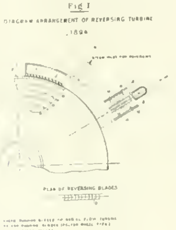


Fig 2.

Diagram arrangement of reversing turbine 1907

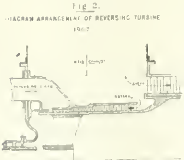


Fig 3

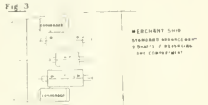


Fig 4

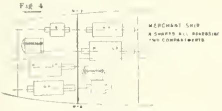


Fig 5

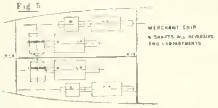


Fig 6

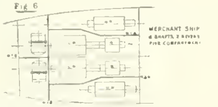


Fig 7

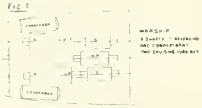


Fig 8

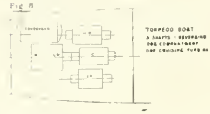


Fig 9

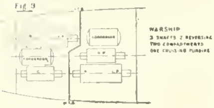


Fig 10

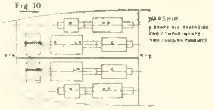


Fig 11

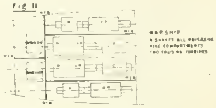


Fig 12

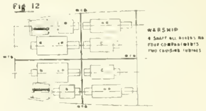
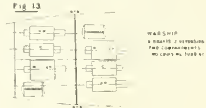


Fig 13



Warship engines are undoubtedly light in proportion to power developed, and therefore more liable to wear and tear, and modern increased demands for naval efficiency compel warships to be at sea more than formerly Their engine-room staff is usually smaller in proportion to the power than in the merchant service, and they do not return to home ports with the regularity of a liner.

Figures officially ascertained of service results have recently been published showing the actual comparison between the turbine and the reciprocating engine in sister ships We reproduce these below :—

COMPARISON OF SERVICE COAL CONSUMPTION

Speed Knot	Turbine Destroyer Coal per hour	Sister Boats with Reciprocating Engines Coal per hour	Speed Knot	Turbine Destroyer Coal per hour	Sister Boats with Reciprocating Engines Coal per hour
[illegible]		0 333 tons	15	1 0 tons	1 0 tons
[illegible]	0 38 tons		17	1 5 ,,	1 5 ,,
9		47 ,,	18	2 1 ,,	
[illegible]	0 545 ,,		21	4 0 ,,	3 85 ,,
12	0 68 ,,	0 67 ,,	24		7 5 ,,

Further, the greater part of these service tests were made at a fraction of the full power, evidently unfavourable to the turbine A comparison of full-speed results would give figures even more striking

It has been proposed by the application of superheat to increase the economy of both reciprocating marine engines and turbines, but it should not be lost sight of that the early use of superheaters on board ship dates from half a century ago, and, although superheaters are extensively used for land work, very few are yet to be found on board ship, on account of the greater difficulties incurred in the maintenance of such superheaters and engines for marine work

As to the question of turbine economy in warships at cruising speeds, which at one time was thought likely to prejudice their application, not only has experience proved this to be more favourable than was supposed, but the modern trend of naval tactics has led to the adoption of increased speeds for cruising purposes

At one time, mixed installations of reciprocating engines and turbines were favoured for high-speed warships, the reciprocating engine to bear the brunt of the work at the reduced speeds, but this arrangement has now been abandoned almost everywhere. It cannot be too strongly emphasised that the true *rôle* of the mixed system is for those installations where the designed full speed of vessel falls below the range suitable for turbines alone, the reciprocating engine working in the region of pressure drop

where the conditions are best for it, and the turbines utilizing that low-pressure portion of the expansion diagram which the reciprocating engine is not able to utilize economically, and filling up the gap between release and condenser pressures. Such a combination of reciprocating engine and steam turbine has been advocated for a considerable time for vessels whose designed speed is below about 15 knots, a class which comprises nearly two-thirds of the mercantile steam shipping of the world, and the saving in coal consumption for such ships over what it would be with the best quadruple engines is estimated to be from 10 per cent. to 20 per cent., according to the type of vessel fitted. In the case of an intermediate type of Atlantic liner of about 15 knots speeds, the saving in coal is estimated at 12 per cent., while the first cost remains about the same as it would be for quadruple engines developing the same total horse-power and speed of vessel, and the total weight of machinery would be less.

An interesting development in connection with the application of the marine turbine has been the great impetus given to the production of reliable means of ascertaining the power transmitted through shafts. The recent papers read before this Institution have dealt very fully with this interesting subject, and, though improvements in detail and convenience of application may perhaps still be expected, the marine engineer possesses to-day instruments at least as accurate as the ordinary reciprocating engine indicator.

The comparative weight of turbines and reciprocating engines is a question which is frequently referred to. The laws which govern variation in weight of installations of the two types are somewhat different. What may be termed the limiting factor of reciprocating engines is piston speed, while for steam turbine installations it is the minimum propulsive surface of the screws and the speed of the ship which in turn impose the maximum number of revolutions. These limiting factors, however, operate in practice very differently, because the higher limit of piston speed is one to which, from the point of view of efficiency regardless of weight, there is nothing to gain by approaching too closely. In the case of the turbine on the other hand, not only does weight diminish, but efficiency also increases, by approaching the higher limit of revolutions or peripheral speed. Again, the durability of a reciprocating engine is increased by limiting the piston speed. In the case of the turbine, increased revolutions, which permit of smaller dimensions, add to both its mechanical perfection and its efficiency.

Thus we find that for given speed and horse-power and efficiency, there is very little variation in the weight of turbines, whether for mercantile or naval purposes. On the other hand, reciprocating engines will vary very considerably, as, for instance, in the case of a large cruiser and Atlantic liner of the same power and speed, the mercantile vessel will have engines 50 per cent. heavier than the warship.

If we compare these two vessels with turbine engined ones, it will be found that the turbines for full power will weigh nearly the same in both liner and cruiser; but in the case of the warship, as the complete installation generally includes also cruising turbines for the reduced speed, the total weight will be actually heavier than that for the mercantile vessel, thus reversing the case of the reciprocating ships.*

For similar engines, with the same piston speed, the power of reciprocating engines varies about as their $(\text{weight})^{\frac{2}{3}}$. With turbines for the same power the weight varies considerably for different speeds of ship, the turbines being relatively much heavier for low than for high-speed vessels.

It will generally be found when comparing turbines and reciprocating engines that the weight and cost of the turbine installations begin to exceed those for reciprocating engines at about the same point as that at which the steam consumption of the turbine becomes too high for practical application, *i.e.*, in ships where the propulsive conditions and speed of ship begin to rule the turbine out of court. Thus, we may say that up to the present time, for all mercantile applications, the turbine has been lighter than ordinary reciprocating engines to give the same speed of ship. In some cases this saving has exceeded 30 per cent., while in others the weight has been very nearly equal.

In battleships and cruisers, turbines are about the same or less weight than reciprocating engines. It is only in vessels of the destroyer and torpedo-boat class that the reciprocating engine is able to beat the turbine on the score of weight, with this difference, that the reciprocating engine becomes so frail as to have but a very limited capacity for full-speed running, and can indeed only be run at full speed by the aid of the most careful nursing; while, on the other hand, it may be justly claimed for the turbines of a destroyer or torpedo-boat, that they require no nursing, and are always as ready for continuous running at full power as those of a larger ship. It has been stated above that turbine weights cannot be much varied for constant conditions. Exception should be made to this statement so far as weights are influenced by test and boiler pressures. It has been found that the boiler pressures adopted in recent years for reciprocating engines are generally higher than are necessary in similar vessels fitted with turbines in order to secure the best and most economical results; but we wish here to point out the influence of specified *test pressures* on turbines, and as about 40 to 45 per cent. of the weight of the turbine is on an average directly affected by the test pressure specified, and as this proportion of the weight varies in direct ratio to the test pressures for equal stresses in material, it is seen how largely the total weights of the turbines are affected by the boiler pressure.

In choosing a test pressure, the case should be considered on its merits, instead of simply applying the rules made for reciprocating engines, which are subject to unknown pressures due to the shock caused by water entering the cylinders. In the case of turbines, it is impossible for any part of the system at any time to receive a higher pressure than that of the boilers. The turbines constitute, in fact, a series of open pipes of gradually increasing section right away to the condenser, which in turn communicates through the air-pump valves with the atmosphere. When taking into account the drop of pressure that occurs through the system, and even before reaching the H.P. turbines, it will be seen that no reason exists for applying tests more than a very moderate amount in excess of the steam pressure in each turbine. Excessive test pressures are undesirable for another reason, in that, if applied after the final boring of the cases, the metal may be permanently strained and distorted.

The question of condensing plant is a very important factor with turbines, on account of the greater expansion dealt with in the turbine as compared with reciprocating engines. A good vacuum is much more essential for the former than for the latter, and here, again, the designer, in some instances, is limited in marine work by considerations of weight and space. In all cases it is desirable that the condensers, circulating pumps, and the air pumps should be designed of such a size as to maintain as high a vacuum as possible. The vacuum augmentor has now been applied in connection with several land and marine turbine installations with very good results, and has augmented and maintained a high vacuum closely approaching the limit imposed by the temperature of the cooling water.

The length of this paper prohibits extended reference to the subject of arrangement of turbines on board ship. The diagrams, Fig. 3 to Fig. 13, show most of the arrangements which have been carried out or proposed for ships engined with Parsons' turbines. For all merchant vessels, except for the very largest, the three-shaft arrangement with one high-pressure and two low-pressure turbines, as originally designed for the pioneer vessel *King Edward*, still proves the most advantageous (Fig. 3).

The largest vessels may require four shafts to keep the turbines within reasonable dimensions, or to enable the engine-room space to be conveniently sub-divided by bulkheads. Several modifications are then possible, and the position of the bulkheads is more a matter concerning the shipbuilder and his stability calculations than the engineer. Other considerations being equal, it would appear that that arrangement is best which leaves stability unimpaired in the highest degree in the case of a compartment being flooded, and avoids the perforation of bulkheads by very large steam or exhaust pipes. (Fig. 4 to Fig. 6 show four-shaft arrangements for large merchant vessels.)

For warship arrangements the conditions are even more diverse. In Great Britain, single engine-rooms are in favour for all classes of torpedo-boats and destroyers, sub-division only being employed in the larger types of vessels, but other countries have required it even for moderate-sized destroyers. Naturally, in such narrow boats the longitudinal bulkhead would be inconvenient, and, from the point of view of stability, dangerous; but even with a three-shaft arrangement it has been found possible to fit a transverse bulkhead (Fig. 9.)

Larger warships are being fitted with various combinations of bulkheads, which seem to have been derived principally from established previous practice in ships with reciprocating

* This comparison leaves out of consideration the heavier condensers, pipes, and auxiliary machinery usually fitted in merchant ships.

engines. Each additional bulkhead introduced has its pros and cons, and additional security from damage by collision or torpedo attack may be too dearly paid for by increased complication, extra weight, difficulty of supervision, and increased *personnel* in the numerous compartments. Facility of repair and overhaul of the machinery may also be prejudiced.

These are questions which should be examined in the very earliest stages of a warship design, and where it should be the aim to establish a thoroughly good understanding and collaboration between the designers of the ship and of the machinery.

ELECTRICITY ON BOARD SHIP.

XII.*

By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc. M.I.C.E., Etc.

The Three-Wire System. Balancing the Two Halves of the Service. The Electric Balancer.

IT was mentioned, in the last article, that in the latest arrangement of generators, on the three-wire system, one generator of double the pressure, that is of the full pressure between the two outer conductors, is employed in place of, as in the early days of the arrangement, two generators connected in series, and that this necessitates some additional apparatus to handle the extra load on the more heavily loaded side, when there is one.

It should be mentioned, in passing, that the three-wire system is worked with generators in parallel, the three-wire service being considered, so far as the arrangement of the generators is concerned, as a two-wire system, the two wires being the outers. Thus with a light load, there may be one generator having its terminals connected, through the switchboard, to the outer conductors, and when the load increases additional generators are brought into service, just as with a two-wire system, their terminals being connected to the two bus bars on the switchboard, that are connected to the outer conductors. When the load decreases, generators are taken out of service, just as with the two-wire system.

Balancing is accomplished by a transference of a part of the load from the heavily-loaded side to the lightly-loaded side, or to put it in another way, by making the lightly-loaded side furnish a portion of the current being used by the heavily loaded side. This is what is done by the electrical balancer, which is probably one of the most beautiful examples of the flexibility of electrical apparatus, and of the easy transference of energy from one point to another. The electrical balancer consists of two shunt wound continuous current dynamos, both of which will furnish current if driven by mechanical power, and will deliver mechanical power if furnished with a current. The axles of the two machines are connected together the armatures revolving together, and, of course, at the same speed. The armature coils of the two machines are connected to the two sides of the service, through their brushes, one armature being connected between the positive outer conductor and the neutral, and the other armature between the negative outer and the neutral, the two armatures taking current from the two sides of the service, just as lamps or motors do. The shunt field coils of the two machines are also connected to the two sides of the service, but in a reverse manner to the armature coils. Thus the shunt field coils of the machine whose armature is connected in the positive side of the service are connected between the negative outer and the neutral, and the shunt field coils of the other machine are connected between the positive outer and the neutral. Thus it will be seen that the armature coils and the field coils of the two machines take their current from opposite sides of the service and it is by this arrangement that the transfer of a portion of the load is obtained. There is a very peculiar feature in connection with electric motors that will be dealt with more fully later, *viz.*, when the exciting current of an electric motor is reduced, or the strength of its magnetic field is reduced, the armature runs faster. There is another feature in connection with electric distribution that has been partly explained, but will also be dealt with more fully later on, *viz.*, when the current passing through any pair of conductors increases, the pressure at the end of the conductors falls, unless some arrangement is made to supply the difference. When one side of a three-wire system is loaded to a greater extent than the other, that is to say, when more lamps or motors, more current in fact, is being taken from one side, say the positive, than from the negative, the pressure between the positive outer and the neutral will fall. As the half of the balancer whose armature is connected in the other, the negative side, takes its current for its field coils from the positive side, the magnetic field in which the armature of the negative half of the machine revolves will be reduced, and the machine will run faster. But, its armature being connected mechanically to the armature of the positive half, it will drive the latter faster than it runs normally, and will thereby cause it to furnish an increased pressure, the increased pressure furnishing the increased current required to meet the difference in the load on the two sides. When the load on the two sides is equal, or about equal, the two machines merely run as motors, but without any load, and take only sufficient current to enable them to furnish the necessary magnetic fields to overcome their own friction, and meet other standing charges, but immediately one side takes an appreciably higher load, the pair of machines commence to run faster, and continue to do so, till the difference is reduced by lights being turned out or motors off, on the more heavily loaded side.

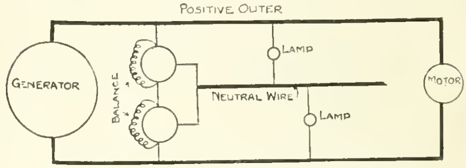


Diagram of connections of steam-driven balancer.

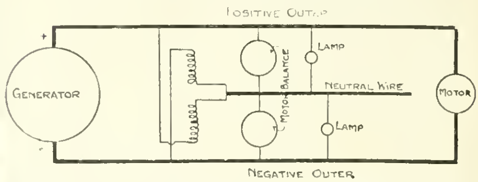


Diagram of connections of an electrical balancer, showing the generator, the armature coils of the motor balancer and the field coils, with lamps, etc., as usually arranged.

The above very beautiful arrangement is gradually giving way, on shore, to the more simple, if less beautiful, method of simply furnishing the required additional current by means of a steam-driven balancer. There are various causes of complaint in connection with the electrically-driven balancer. It requires a good deal of attention, and sparking is apt to take place at the brushes of one or other of the machines, when there is much out-of-balance current to be provided for. As also the whole of the current has to be furnished by the steam plant, there is a good deal to be said for furnishing any out-of-balance current directly by a smaller engine and dynamo specially arranged for the purpose. The electrically-driven balancer does not respond either as quickly as is desired to changes of load between the two sides of the system, and the switchboard connections for it, to enable proper control to be obtained are rather complicated.

The Steam Balancer.

The steam balancer consists of exactly the same two dynamos, having their armatures connected together mechanically, in the same manner as the electrically-driven apparatus, but the two axles are connected mechanically to the crank

* For Articles I. to XI. see last eleven issues.

shaft of a steam engine, and receive all their power from it. The armatures of the two machines are connected, one in each side of the system, in a similar manner to the electrically driven balancer, but the shunt field coils are connected to the brushes of their own machines, in the usual way. The machines do not act as motors at all, always as generators, and they furnish the out-of-balance current to either side of the system by the pressure at the terminals of the machine connected in that side being increased. The two machines always run necessarily at the same speed, but it will be remembered that the pressure a dynamo can generate depends upon the strength of the magnetic field, in which its armature revolves, as well as upon the speed at which the armature runs, and hence it is possible by constructing the machine so that there is a working margin in the field magnet coils, to vary the pressure it is generating, and thence the current that is being taken from it by varying the strength of the current passing in its field coils. In practice the machines are usually arranged to furnish about one-tenth of the full load of the system they are balancing, though there is a tendency to increase this fraction, as the steam balancer makes a very good generator for very light loads. When it is being used as a balancer, and when the load is about equal on the two sides of the system, the field coils are allowed to take very little current, only sufficient to keep their magnetism above the point at which it is easily lost, the speed being arranged as convenient. What is required is that the machines shall be doing no work when there is no balancing required, and shall be ready to furnish the out-of-balance current very quickly. When either side shows an increased load, the excitation of the half of the balancer connected in that side is increased sufficiently to furnish the additional current required, and the excitation is reduced again, if the load is reduced on that side, the other side being similarly dealt with if the load moves there, and so on. As the steam balancer is really a double generator, it will be evident that it can be employed as one, the two dynamos being run at a speed sufficient to furnish the required pressure, and the excitation of each being regulated in accordance with the load on that side. The steam balancer is virtually the early arrangement of the three-wire system, but with each machine arranged to take care of its own half of the load.

The electrically-driven balancer can be regulated by the excitation of its field magnet coils, on the two halves of the machine, just as the steam driven balancer can.

There is a modification of the electrical balancer that is gradually coming into use, in which the generators furnishing current to the system are fitted with rings, running on their axles, on the opposite side of the armature to the commutator, the rings being connected to certain points in the armature windings. The rings are also connected to the coils of a special transformer, an apparatus that will also be described later, that is employed for changing the pressures of supply services, with alternating currents, and the balancing is claimed to be accomplished automatically by the currents taken from the armature to the rings, and passed through the transformer. The currents taken from any fixed points in the armature coils of a continuous current machine will be alternating, and these act in the transformer to give the necessary increased pressure on the heavily-loaded side. In the figures given, which are reproduced by permission of Messrs. Harper, the publishers of the writer's book on Electricity in Mining, the connections of steam and electric motor balancers are shown. It will be noticed that lamps are shown connected in each side of the system, and motors between the two outers. This is a frequent practice on shore, the full pressure being used for motors and half the pressure for lamps.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

Wireless Telegraphy.

INTEREST develops at every turn in this branch of electrical science. A ship has left Copenhagen for New York fitted with a complete installation on the Poulsen system, the first of its kind. It is put forward that by these means communication will be made the whole way from Scandinavia to America, and if accomplished, we shall no doubt hear in due course. We have already seen that this system depends upon obtaining more waves per second on this the continuous plan than was possible before with the discontinuous method. This is done by surrounding the arc by an atmosphere of hydrogen and the difference thereby resulting is enormous. The Company owning these patents has no hesitation in predicting the successful transmission of messages across the Atlantic at a satisfactory speed to meet passengers' requirements. It is agreed that by this new arc method the syntonizing is much easier and the Morse code may be employed. At the same time, great efforts are being made to obtain the same advantages from the spark method, as in view of the ratification of the Convention at Berlin, the various systems must be able to take messages from one another, whatever the principle employed. Meantime, it is announced that the Marconi Co. will be in a position to take messages on a commercial basis across the Atlantic next month, signals having been obtained between Ireland and Canada for some time.

Electric Cranes.

We have previously discussed examples in this direction. A firm who are well known is Dick Kerr & Co., and we have before us specimens of their work in converting what were previously rope-driven cranes into electric ones. Here is evidently a field for exploitation and by a change of this description cranes have been made to double their speeds. In the case of a wharf crane, a 50 H.P. motor is employed, and one of the interesting features is the magnetic brake, the feature of which is that unlike other magnetic systems the effectiveness increases in direct proportion to the current and therefore the more powerful the arc the greater is the hold.

Electricity on the "Lusitania."

As might be anticipated, this remarkable ship is full up with electrical appliances, and no fewer than eleven hoists and lifts have been supplied by Messrs. Waygood & Co., Ltd., of London. Two lifts operate in the stair-well and travel through a height of 36 feet between the main and boat decks. The cars are of polished mahogany and are raised by steel cables through the roof over top sheaves to the winding gear, the counterbalance weights travelling in a trunk way, which forms a ventilator. The winding gear is of the worm and worm-wheel type, while the brake gear is of the electric mechanical type actuated by a magnet, so that the brake is released when the current is switched on and is applied automatically when the current is cut off by the control. To afford absolute security against the lift door being open, automatic locks and electric contacts are so fitted that a door can only be opened when the lift is opposite to it. The generating station is on a flat deck abaft the engine room. The power is derived from Parsons turbines, the revolutions being 1,200 per minute. Each dynamo is shunt wound, the armature being of the surface drum-wound type with one turn per section. Tests were made of these turbo generators and at full load the water consumption was from 46 to 48 lb. per kilowatt-hour. The refrigerating plant is all electrically-driven. The two horizontal gas compressors are each direct coupled to an electric motor, which, by means of shunt regulation, can run at any desired speed from 40 to 110 revolutions per minute. This speed can be regulated by turning one hand-wheel only, the motor running at the same speed as the compressor and without any gearing whatever. The forced draught fans are made by Messrs. W. H. Allen and Co., and these, thirty-two in number, are arranged in pairs and driven by sixteen motors. The diameter of the fans is 66 ins. and these are capable of giving an air pressure of $3\frac{1}{2}$ ins. when running at 450 revolutions per minute, the motors developing 50 B.H.P. when receiving current at 100 volts. As these sets have to run in a high temperature, precautions have been taken as to ventilation, a special fan being employed for this purpose alone. The controllers for the motors give a variation in speed of from 185 to 500 revolutions per minute. Messrs. Laurance, Scott & Co., of Norwich, supplied twelve fans of 35 ins. diameter for ventilating the engine rooms, for which the firm's standard type of semi enclosed motor was employed. Series winding of

the magnets is adopted as giving a better regulation of the load than the shunt system does. This firm also supply the four boat-hoisting gears, electrically operated. The brakes on these boat hoists depend for their action on the magnetic field of the motor itself and come right off with ordinary work and into action as the load is reduced. There are four deck cranes and baggage hoists made by Messrs. Stothert and Pitt, all electrically driven, separate enclosed motors being employed for lifting and slewing. A feature of this firm's system is that a free barrel is used, so that when the load is lifted the barrel is released and the load lowered under the control of a foot brake, the motor thus only running in one direction. The wireless telegraphy is on the Marconi system and this apparatus enables communication to be kept up with other ships and the shore during the whole of the voyage. There are many minor applications of electricity, the large kitchens furnishing many examples. We may mention the roasters, bread-making, potato-peeling, bread-cutting and dish-washing. Then the water-tight doors on the Stone Lloyd system, though operated hydraulically, have electric indicators to show the officer on the bridge the position of these doors and bells to ring when these doors are in motion to act as a warning below deck.

PARAGRAPHS.

Pneumatic Tools.—A paper on the subject of portable pneumatic tools, prepared by Mr. Herbert Bing (Fraserburgh), for the Aberdeen meeting of the Institution of Mechanical Engineers, we have read with considerable interest, and commend it to the attention of our readers to whom the adoption of such tools as are described may prove of economic value. The author points out that the use of pneumatic tools has greatly extended of recent years; this has been brought about by two excellent reasons, the first proves that the spirits of enterprise and of wisdom have been combined in the manufacturers who have placed in the market reliable and good tools; the second proves that by their general adoption the cost of production has been reduced in those trades where pneumatic tools can be utilized more effectively than hand labour. Hammers for caulking, chipping and riveting are now found in nearly all the shipyards, engine works and repairing shops throughout the kingdom, and have been found not only a means of reducing the cost of production, but of great facility in executing work in awkward corners. A case is cited where the sludge door in the boiler of a trawler at Aberdeen leaked badly, due to the face of the flanged-in plate being uneven. Owing to the confined space the job could not be done by hand save under considerable disadvantage in time and labour. The trawler was taken alongside the works of the John Duthie Torry Shipbuilding Co., the boiler emptied and the faces faired by a pneumatic tool and finished in a few hours ready for work again. In boiler scaling another case is cited, showing the comparative cost of removing scale from a Cornish boiler by hand labour and by pneumatic tools, the saving on labour only being represented by the difference between £22 4s. and £5 11s., and the saving in time by the difference between 6 days and 3 days. Riveting hammers are now made to cope efficiently with rivets up to $1\frac{1}{2}$ in. diam., so that there is a very wide range of work to which these can be applied, ship work, tanks, boilers and constructional work of all kinds. There are many varieties of hammers, each of which appears to find a ready market at home and abroad, and having its own special claim for handiness in working. Pneumatic drills are tools of great service both in new and in repair work for boring and tapping stay holes in fireboxes, or for boring out the stays themselves when necessity asises. The fairing of rivet holes the tapping of stay holes, the expanding of tubes and similar work are now done by means of these tools with celerity and satisfaction. The work accomplished by means of this class of tool is quoted in connection with the construction of the Vauxhall Bridge, as averaging 500 holes $\frac{1}{16}$in. diam. per ten hour day per drill through two plates together, one of $\frac{1}{2}$ in. and one of $\frac{5}{8}$ in. or $1\frac{1}{8}$ in. thick in all. For salvage operations, bridges, piers, wharves, wood and iron work under water and such like the pneumatic drill is stated to be of great value as also in mining ores and coal. The mechanism for reversing motion is ingenious and neat. One of the midget drills, referred to as the smallest made, can deal with holes in steel $\frac{3}{16}$ in. diam. The weight of the tool inclusive is $2\frac{1}{2}$ lbs., the speed of the motor being 22,000 revolutions per minute, and the spindle 2000 revolutions per minute. For stone dressing and armour plate scaling special tools are made and used with considerable success, while for removing scale from the inside of water-tube boiler tubes, the pneumatic tool has proved itself an important implement in the economy of an installation of water-tube boilers.

Loch Long Torpedo Range. — The proposal of the Admiralty to make use of Loch Long as a testing place for torpedoes has raised a considerable amount of adverse criticism from those who look upon the loch and its surroundings as a holiday resort, or as a place of beauty for the eye to dwell upon from the moving platform afforded by the touring steamer. In view of this we sympathise with the shudder which passes through the consciousness of one who has bent delighted gaze from the adjoining hills upon the waters of the loch, or has sojourned, a restful lingerer upon its shores. Yet we cannot but realize that the proposed testing ground is well suited for the purpose and convenient to the new manufacturing centre on the opposite side of the Firth of Clyde. The fears that have been raised as to the quiet and peaceful grandeur of the neighbourhood being spoiled by the introduction of the Admiralty need not be

Loch Long.

realized and probably will not be, as the testing arrangements should be made to avoid interfering with the convenience of the general public and the safety of the lieges who frequent the loch, by well defined marks and times. The proximity to Ardkinglass, or as it has been renamed Ardgoil, the Mountain Park of Glasgow, presented to the Corporation about two years ago, complicates the question slightly, but even then the difficulty of dealing with the arrangement of details can be overcome when the suitability of the place is considered.

Course Recorder. The sword which hangs over the bench at the Court House, while being representative of Justice, also reminds one of the machinery at work throughout the nation to keep in order the details of daily life and regulate the pathways along which men may walk to barter with their fellows, gather gains wherewith to luxuriate or add pile upon pile for others to scatter on the highways and byways of life. The straight path is not always chosen or adhered to—the crooked path seems to have a fascination for many. The regulation of the course of a steamer from port to port is a matter which may affect the coal and speed to a considerable extent and the quality of the human element in connection with the steering is an important factor to which attention cannot be too often called, that those, whose duties are concerned with the coal consumption and whose strict attention to expenditure, the success of a voyage largely depends, may be kept alive to the rudder and its uses. The steersman in days long gone by was an important person, as references in the writers of the old world's history and fables show. From our own experience in rowing we have realized the importance of the manipulator of the rudder, and the deterrent effect upon the boat when an unsteady

course has been pursued by the hand on the tiller, resulting in greater muscular effort to ourselves and less progress than when a steady course has been the rule. We have heard it stated as an illustration of what a steersman can do, that the pathway of a steamer has been as the course of a serpent through the air, an illustration which has been justified by a diagram shown to us some time ago, indicating by means of a recorder the almost constant movements of the rudder. Such a recorder as that referred to would appear to be a desirable adjunct to the outfit of a steamer, serving, as it should, to give the steersman an object lesson and impress upon him the importance of avoiding movement rather than the reverse. The human element is here very manifest, some steersmen seem to "feel" the amount of helm necessary for a set course intuitively and by a touch maintain it, while another never seems to realize what it means to the machinery to keep the wheel or tiller continually on the move. The ease and celerity with which the rudder is moved now in the largest of steamers is not an unmixed good, as the effort necessary to move from port to starboard is so slight that the man who cannot keep still imparts more of the zig-zag movement to the vessel than if he had to exert his full strength to his task. In this case the alert man of inaction is the man on whose action the best results will follow in the day's run for speed and consumption, while the tear and wear on the steering machinery, as well as on that for driving the ship through the water, will be reduced to a minimum. We have seen and experienced both classes of steersmen, and commend the man who can keep a course with the least possible expenditure of energy and, next to him, we commend the man who can be taught to so keep a course when it has been impressed upon his understanding that the steady course straight and true is the one most desired.

William Jacks, LL.D., the founder of the firm Wm. Jacks & Co., iron merchants, Glasgow and London, who died on August 10th, was a man of many parts. He was a native of the border county of Berwick, son of a shepherd and had to start work early in life; being eager to make up for the lack of advanced school education, he employed what time he had after working hours and at odd moments to improve his mind and employ his talents. By dint of this, he equipped himself for the distinguished position which he held in later years. He worked as a youth in a ship-yard on the north-east coast and from the practical he was transferred to the commercial side. From the north-east coast he removed to Glasgow as manager of a firm and afterwards commenced business on his own account. He was member of Parliament for Stirlingshire in the Liberal interest for three years. His attainments as a linguist were exceptional, and stood him in good stead on many occasions in dealing with business matters of a somewhat difficult and delicate nature, saving the firms he represented, by his acumen and unsuspected knowledge of languages, from considerable losses. In one case where a consignment of iron to a continental firm had been complained of with a view to reduce the cash value, he determined to investigate the question himself and proceeded to the spot. The commercial representative of the purchasing firm tried to bluff him on his arrival, but nothing short of an examination of the consignment would serve, and at length he was shown the iron at the works, where he demanded to see the foreman, with whom, as a practical man, he could discuss the qualities and presumed shortcomings of the material. Finding out the special *patois* of the foreman, he used it in discussing the merits of the iron with him—much to his astonishment—and gained the admission that the complaint originated, not from the practical, but the commercial (?) side of the house. The result was he gained his end, and not only saved the reputation of his own firm, but a monetary loss by his ability to talk to a man in a language not generally known. His "Life of Bismarck" and "The Life of the Emperor William II.," are acknowledged to be works of ability and of standard value. The German Emperor presented a signed portrait of himself to Dr. Jacks as a souvenir of his appreciation of the correctness and worth of these volumes. There are several other contributions to the literature of the country which emanated from the pen of Dr. Jacks, and as a testimony of the interest he took in educational work and especially of the value of languages, he has left by will £20,000 to endow a chair in the Glasgow University for modern languages, while as a further encouragement he has also left two sums of £1000 to endow scholarships in the hands of the Edinburgh and the Glasgow Border Counties' Associations. Besides many legacies to societies having for their objects the amelioration of those who are overtaken by misfortune, souvenirs were provided for by the will to be given to many who were associated with the legator during his business career, thus evidencing a kindly thoughtfulness towards his clients and colleagues which shows the broad spirit of the man.

Messrs. Suter, Hartmann & Rahtjen's Compositions Co., Ltd., have sent us a list of some of the vessels supplied by them during the recent three months, total 2,840,040 tons.

The "Waipara,"—B.I.S.N. Co.—we note from the *Brisbane Mail*, arrived at Brisbane from London on June 22nd, after a run round the Cape of fifty-six days without a single stop, thus making a record passage, in spite of some unfavourable weather which was encountered during the voyage.

Institute of Marine Engineers.—The members of this Institute will visit the Engineering Exhibition on September 28th, when two papers will be read and illustrated by lantern slides and diagrams on "A new method of repairing boilers," by Mr. H. Ruck Keene, and "Sanitation and Ventilation" by Mr. A. E. Battle.

Sir Wm. Copeland, LL.D., who died on August 19th, was a citizen of Glasgow, whose efforts on behalf of his fellows were greatly appreciated by a large section of the community. His success as a civil engineer brought him into prominence, not only in this country, but abroad, while his work in connection with the West of Scotland Technical College has been worthy of all praise. Sir William was born in Stirling about sixty-nine years ago, he was educated in Glasgow and attended the University, where he attained to eminence in mathematics.

Messrs. James Walker & Co., "Lion" Works, Garford Street, West India Docks, London, E., will again be represented at the Engineering and Machining Exhibition, Olympia, and are showing *a unique* collection of their *Genuine* Manufactures; comprising the new **Golden "Walkerite" Jointing** for **Steam, Water, Acid, Ammonia, Petroleum** and every description of Joints **(an "Ideal" Joint for Motor Engines)**; their new (Patent) **Graphite-Grease Bricks** for *heavy* bearings; **"Kerko" Ammonia Packing;** and **"Wallico" Cone Gauge Glass Rings,** etc., all of which will be found of great practical value to every Engineer. *A new feature* has been introduced in all these packings, as a means of identification, *viz*: a **"Thin Red Line"** (fully protected by Copyright), which runs right through them, and Brass Trade-Mark Labels which are attached.

Iron and Steel Institute.—In accordance with previous announcements, the autumn meeting of the Iron and Steel Institute will be held, by kind permission, in the House of the Austrian Engineers and Architects Society in Vienna (I. Eschenbachgasse, 9), on Monday and Tuesday, September 23rd and 24th. The following is a list of Papers that are expected to be submitted:—(1) "On the Development of the Iron Industry of Austria since 1882," by W. Kestranek (chairman of the Reception Committee); (2) "On the Styrian Erzberg Iron Ore Mines," by Professor H. Bauerman (honorary member); (3) "On Steel and Meteoric Iron" by Professor F. Berwerth (Vienna); (4) "On the Determination of the Quantity of Blast Furnace Gas for a given make of Pig Iron," by Professor Josef von Ehrenwerth (Leoben), honorary member; (5) "On the Application of the Laws of Physical Chemistry to the Metallurgy of Iron," by Baron H. von Jüptner (Vienna); (6) "On Case Hardening of Mild Steel," by C. O. Bannister, Assoc. R.S.M. (London), and J. W. Lambert, Assoc. Inst. C.E. (Woolwich); (7) "On a new Blue Black Paint as a Protective Covering for Iron," by F. J. R. Carulla (Derby); (8) "On the Hardening of Steel," by L. Demozay (Unieux, France); (9) "On the Structure of Hardened Steel," by Percy Longmuir (Sheffield); (10) "On Case Hardening," by G. Shaw Scott, M.Sc. (Birmingham); (11) "On the Ageing of Mild Steel. Further Notes," by C. E. Stromeyer, M.Inst. C.E. (Manchester); (12) "On the Economical Distribution of Electric Power from Blast Furnaces," by B. H. Thwaite (London).

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

Work achieved.—Thoroughly "into harness" again, after the "Fair holidays," Clydeside artizans, since the advent of August, have shown what metal they are made of, and have enabled the firms employing them to make a creditable score in the matter of tonnage launched and of individual steamers put through their facings as to speed, consumption and steering. For particulars as to the work achieved in these directions, readers may be referred to the "Launches" and "Trial Trips" sections in this issue. Suffice it to say here that the most notable of the vessels launched included the *City of Paris*, the latest addition to the Ellerman-City line, sent off the stocks by Messrs. Barclay, Curle & Co., Whiteinch, and that the vessels tried for speed included the turbine steamer *Maori*, built and engined by Messrs. Denny Brothers, Dumbarton, for the fast passenger service of the Union Steamship Co., of New Zealand.

New Shipbuilding Contracts.—Since the notes in last month's issue were penned—about the 25th July—a highly gratifying volume of fresh work has been placed with the shipbuilders of Clydeside and other Scottish districts. In the aggregate, and up to date of writing these notes—August 22nd—the new tonnage booked runs to close on 70,000 tons gross. While on the whole pretty well distributed, this influx of additional work still leaves a number of the important yards in the upper reaches of the Clyde very poorly off, but ere the month closes or at all events before next month's notes fall to be penned, this condition of affairs will have mended. Enumerating the new orders, not so much in the order of their actual placing as in respect of their importance, the first items calling for notice are two twin-screw mail and passenger steamships ordered for the P. and O. fleet. One of these has been placed with Messrs. Caird and Co., Greenock, and the other with Messrs. Barclay, Curle and Co., Whiteinch. Each, it is believed, is to be of 11,000 tons gross, 540 ft. in length, 61 ft. beam and 37 ft. 3 in. deep, and they will be the largest vessels yet built for the P. and O. Company. Fitted sumptuously for the passenger and mail service—for the Australian route it is believed—each will have twin-screw engines of the reciprocating quadruple expansion type, supplied by the builders in each case. It is stated that fourteen firms sent in tenders for these vessels.

The Union Steamship Company of New Zealand has ordered a large passenger steamer from Messrs. Alex Stephen & Sons, of Linthouse, to be employed in their trans-Pacific service. Although this Company have had, and are still ordering—the *Maori* just about finished by Messrs. Denny, of Dumbarton, for example—turbine propelled vessels, this one is to be fitted with four-cylinder, reciprocating, triple expansion balanced engines, driving twin screws. The speed stipulated for is 16½ knots on a twenty-four hours' trial. She will carry 250 first-class, 160 second, and 100 third-class passengers. She will be employed in the Company's service, which once a month takes the British mails to New Zealand from the Canadian port to which they have been carried by Canadian Pacific Railway Atlantic steamers and the Canadian Pacific Railway. Originally the Union Company's vessels only served along the New Zealand coast, but now, in addition to a large inter-colonial trade, it has services to Singapore, Calcutta and Vancouver. It has at present a fleet of about sixty vessels, having a gross tonnage of over 160,000 tons, and at the moment four vessels are building for it on the Clyde and one at Sunderland in the Wear. Messrs. Russell & Co., shipbuilders, Port Glasgow, have contracted to build for Messrs. Robert Shankland & Co., Greenock, a steamer of 400 ft. in length, 52 ft. beam, and with a carrying capacity of 8400 tons. This vessel, which is intended for the general cargo trade between New York and the Continent, will be engined by Messrs. Rankin and Blackmore, Greenock. The Greenock and Grangemouth Dockyard Company have contracted to build for South American ownership a steamer of 3000 tons, 270 ft. in length, 44 ft. beam and 19 ft. deep. The Scott Shipbuilding and Engineering Company, Greenock, have been commissioned by Mr. Roy A. Rainy, of New York, to build and engine a twin-screw yacht 238 ft. long, 32 ft. 10 in. beam and 12 ft. 3 in. draught, whose tonnage will be about 1400 tons. Messrs. D. J. Dunlop & Co., Port Glasgow, have contracted to build a steamer of 225 ft. in length for Messrs. Elder, Dempster and Company, Liverpool, for their West African trade. Messrs. Napier & Miller, of Old Kilpatrick, have contracted to build for Messrs. Hugh Hogarth & Sons, Glasgow, a steamer of about 7500 tons deadweight carrying capacity.

While these notes are being penned a statement is published on what seems trustworthy authority, to the effect that a well-known shipbuilding and engineering concern on the upper reaches of the river, whose building stocks are almost entirely denuded of work of any kind, have just booked, amongst other important orders for merchant steamships, a contract to build and engine for the Japanese Government a battleship of about 18,000 tons displacement and of great beam. This requires stronger confirmation, but everything points to its being true in essentials, though details which are not here repeated may be wanting in accuracy.

New Vessels for Clyde Cross-River Traffic.—The Clyde Trustees, having some time ago settled that the increased traffic at the Finneston crossing thrown upon the existing ferries there, through the closing of the under-water tunnel, was more than they could efficiently overtake, invited tenders for the construction of a powerful four-screw elevating-deck ferry steamer for vehicular as well as passenger traffic, and for a small steam passenger ferry of the usual type. The contract for the new vehicular ferry has been secured by Messrs. Ferguson Brothers, Port Glasgow, whose tender of £26,450 is stated to be the lowest. The new vessel is to be considerably larger than the present *Finneston* which was built by the same firm in 1898, and than the older *Finneston* built in 1890 by Messrs. William Simons & Co., Renfrew, who, it is worthy of note, were the original inventors of this very special type of cross-river craft, and for years pressed it on the attention of the Clyde Trustees before that body could be induced to adopt it. The contract for the ordinary passenger ferry boat has been given to the Ardrossan Shipbuilding Company. It is to cost £1995, and will be equipped with pumping and other machinery to serve as a floating fire engine, a matter which has also long been suggested for the harbour of Glasgow.

Naval Work.—Early in the month the cruiser *Edgar* arrived in the Clyde from Devonport with a navigating party for the battleship *Agamemnon*, which had some time previously been taken to the Tail of the Bank by her builders, Messrs. Wm. Beardmore & Company, Dalmuir. Hull cleaning in dock, adjustment of compasses, etc., having been carried out, this notable warship, after some preliminary trials, proceeded down channel on the 20th on a thirty-hours' trial at one-fifth power, and after returning to the anchorage next day prepared to proceed on a further thirty-hours' trial at seven-tenths full power. It was, thereafter intended that the vessel should go on her full speed trial of eight hours' duration on the 26th, and then return to her builders' fitting-out basin at Dalmuir.

During the recent stay of the Channel Fleet in Clyde waters, as a matter of course exchange of courtesies and official visits between authorities on ship and on shore were naturally made. One of the visits paid by Admiral Lord Charles Beresford—accompanied by Vice-Admiral Sir Reginald Custance and about fifty other officers—was to the Parkhead Steel Works of Messrs. Wm. Beardmore & Company, and to the same firm's naval construction works at Dalmuir. Commencing the inspection of the Parkhead works about eleven o'clock the party of visitors were shown, among many other things of deep interest, the 12,000 ton hydraulic press—the largest in the United Kingdom—used for forging and bending armour plates, and forging large steel ingots up to 110 tons, the armour rolling mills for plates, bars, etc., and several ranges of steel melting furnaces which, with those belonging to the same Company at Mossend are capable of an output of 300,000 tons annually. They were also conducted over the extensive shops for dealing with armour plate, where at present the armour for H.M.S. *Téméraire*, building at Devonport Dockyard, is being manufactured, and the machine and gun-making shops. The party then inspected the fluid compression press, in which

the Beardmore Trefilage process of casting ingots up to forty tons is carried out, and the immense foundry where such large castings as stern and stern pieces, rudders, propeller brackets, hawser pipes, etc., of battleships are cast. About three o'clock the party arrived by special train at the Dalmuir Works, features which at once arrested attention being the immense standards and runway with electric crane equipment over the building berth where the *Agamemnon* was constructed, and the mammoth 150-ton cantilever crane alongside the company's fitting-out basin. The river frontage of the shipyard is over a mile in length, and the area upward of 90 acres, of which 5½ acres are occupied by the shops of the engineering and boiler-making departments. There are seven building berths, the largest being capable of accommodating a ship 1000 ft. in length by 100 ft. beam. The fitting-out basin, which can accommodate three large vessels at one time, has a depth of water at high tide of 30 ft. In the engineering shops much interest was evinced in the equipment of time and labour-saving tools and arrangements of various descriptions. A feature of exceptional attraction was the spacious power house, wherein the electric generators air compressors, etc., are entirely run by gas engines of the Ochelhauser type, having a total horse power of 5300, the gas for which is supplied from producer plant alongside. Steam boilers throughout the works are conspicuous by their absence.

Of the fresh work placed with Clyde builders, a rough enumeration of which has already been given, a small proportion consists of commissions from the Admiralty. The Ardrossan Dry Dock and Shipbuilding Company, Ltd., have been entrusted with an order for three vessels to be used for horse transport, and the Greenock and Grangemouth Dockyard Company have received an order for five vessels, also for transport purposes. These will be constructed at their Grangemouth yard, and will be towed to Portsmouth.

The Greenock and Grangemouth Dockyard Company have now completed the three caissons intended for H.M. Dockyard at Malta, which were ordered by the Admiralty some months ago. The caissons have now passed their official tests under hydraulic pressure, each caisson being opened and closed in 4½ minutes' time, or half a minute under contract time. The Admiralty officials were present at the tests and formally took over the work. The dimensions of the caissons are 96 ft. by 42 ft. by 22 ft., each weighing 750 tons, and they are built with lowering and lifting bridge on the "Kinniple" principle.

New Clyde Trust Official.—The Clyde Trustees have appointed as their marine superintendent engineer—an entirely new post, and distinguished from that of mechanical engineer held by Mr. George H. Baxter—Mr. William Bell. While the charge of the upkeep of dredgers, barges, ferries and other marine plant will devolve on the new superintendent, his duties will be confined to the actual working fitness of the plant and not to the superintendence of dredging, etc. Mr. Bell, who is a practical engineer, served his apprenticeship with the well-known dredger-building firm of William Simons and Company, and afterwards acted as guarantee engineer on many of their productions. He also served for some time as a sea-going engineer on ocean-going steamers and during the past four and a half years he has been employed by the Admiralty at the new harbour and dock works at Gibraltar.

Scholarship in Naval Architecture.—Some degree of natural gratification has been felt by Clydeside people at the intimation that this year's scholarship of the Institution of Naval Architects has been awarded to Mr. A. M. Robb, of the staff employed by Messrs. G. L. Watson & Company, Glasgow. The scholarship is of the annual value of £50, and, subject to the regulations, is tenable for three years.

THE TYNE.

(*From our Own Correspondent.*)

Threatened Lock-out in the Shipbuilding Trade.—The evening papers of the 17th inst made the startling announcement that lock-out notices had been posted in all the North east shipyards that morning. Later information showed that similar action had been taken by the shipbuilding employers on the Clyde, at Barrow and at Belfast, with the single exception of Messrs. Harland & Wolff, who are not affiliated with the employers' federation. The cause of this wide-spread trouble is stated to have been a strike by the caulkers at a Low Walker shipyard, this section of workers objecting to the apprentice platers being permitted to do what they alleged was their (the caulkers') work. This question of demarcation is a very old source of trouble, and would have been done away with years ago, if the employers had had the power to enforce their wishes, which they appear to possess at the present time. The phrase "demarcation of work" was only introduced some twenty years ago when the joiners and carpenters (also at a Low Walker yard) were giving the world a true object-lesson in trade-union brotherliness in reference to the division of work. Since then the battle has from time to time been renewed in almost every department of the shipbuilding and engineering trades, and the war over such vital questions as the screwing up of bolts or the cutting out of rivets, has cost both employers and men huge losses of both time and money. In the world of industry, the phrase "demarcation of work" has really no legitimate place. It is the prerogative of the employer through his representatives to apportion the work among the employés, in such ways as may seem to him or them most expedient. It would be as reasonable for a policeman or a postman to insist upon defining the particular districts they should "work" as for a workman to claim the right of selecting his own "job," and of excluding other workmen from sharing in it. Such pretensions are clearly out of place and must be put down peremptorily. In spite of the threatening aspect of affairs, we do not apprehend any serious trouble in respect of this matter. The officials of the Boiler-makers' Society, seeing that the employers are in earnest, will very speedily order the Low Walker caulkers back to work, and the employers, with their customary readiness to accept overtures for peace will, doubtless, consent to withdraw the lock-out notices. In the subsequent conferences that are sure to take place however, the employers will insist upon full recognition of their rights as such, and a distinct gain to industry will thus be achieved.

State of Work in the Yards.—It is stated that an order for two fast cruisers has been placed with Messrs. Armstrong, Whitworth & Co, by the Government of the Argentine Republic. It is also announced that a Liverpool syndicate has placed an order with the same firm for a large cargo steamer, and that they have also received an order for a tank steamer. Messrs. Swan, Hunter & Wigham Richardson have launched a pontoon dock for Rotterdam lately, and have commenced the construction of another for a different destination. They have also launched a large "Hausa" steamer this month, and an exceptionally fine vessel for French owners. It is understood that the firm have booked further work, comprising a vessel for the Eastern trade and one or two for other services. Messrs. Wood, Skinner & Co., of the Bill Quay Yard, have their berths all occupied, which is quite an exceptional state of affairs at this moment, and one on which the firm may well be congratulated. At Messrs. Dobson's yard, a condition of slackness is very manifest; but at Messrs. Hawthorn, Leslie & Co.'s establishment, the state of business continues satisfactory. Messrs. Stephenson's yard, though not particularly busy, has still a fair amount of work on the stocks, and in the graving dock there is a large vessel receiving an overhaul. Notwithstanding the general falling off in work, the Northumberland yard continues to maintain an appearance of briskness. Messrs. Readhead's yard also is still having full berths, and the smaller yards at Shields are kept pretty busy in the construction of fishing craft.

Ship Repairing at Wallsend.—The Wallsend Slipway and Engineering Co., Ltd., have at present in hand several important repair contracts to high-class vessels, one being in the graving dock and the others lying at the wharves. The Smiths' Dock Co. have most of their pontoons and graving docks occupied with vessels under repair, and the Commercial Dock Co. have also two or three vessels being overhauled. It is understood that a large locally-owned steamer, which was damaged in the river St. Lawrence is now being brought to the Tyne to be thoroughly repaired.

Marine Engineering Work.—At nearly all the large marine engine works night work is being restricted and the number of men working overtime is being gradually reduced. Over-

time, being more expensive than ordinary time, is only resorted to under pressure of necessity, and this circumstance renders artificial limitations unnecessary. At the Wallsend Slipway Works and also at the North-Eastern Marine Works, vessels are being fitted with their machinery, and at other works the engines and boilers under construction are nearing completion. Many of the iron foundries are showing signs of slackness, but in some cases business is still pretty brisk, and especially in the case of Abbots' Foundry, Gateshead.

THE WEAR.

(*From our Own Correspondent.*)

Decreasing Work in the Shipyards.—A very rapid falling off of work is to be noticed in this district, the majority of yards having now most of their berths empty. The establishments of Messrs. J. L. Thompson & Sons, and Messrs. Doxford, are exceptions and continue quite busy, thus showing a marked contrast to the condition of affairs in other yards. The first-named firm were really the first on the Wear to depart from the antiquated methods that were in vogue twenty-five years ago, and have, by improved arrangements in all departments, placed their yard in the very front rank of shipbuilding concerns. In this keen outlook for improved methods, and the ever-present readiness to adopt them when discovered, may possibly be found the secret of their continuing briskness, when most other firms are short of work. Messrs. Doxford's remarkable success is no doubt in a large degree attribntable to their exclusive right in the building of "turret" ships, but they also have been leaders in enterprise and have lost no time in availing themselves of such improvements as were seen to be really effective. Some half-dozen vessels have been launched during the month, but only in one or two cases were new keels placed. The number of berths now vacant on the river reaches the large total of twenty. As the nnmber of berths is less than fifty, it will be seen that little better than half the building capacity of the port is at present being utilised.

The Engineering Establishments.—As is the case on the Tyne and at all the other shipbuilding centres, steadily decreasing briskness is noticeable at all the larger works, and though an appearance of activity is still maintained at some of the establishments where auxiliary machinery is manufactured, the volume of work in this branch of engineering is considerably less than it was six months ago. The electrical department of the Sunderland Forge and Engineering Co.'s works, is, we understand, still quite busy, and in the forging department, the work in progress is sufficient to keep a limited number of hands employed. The electrical generating station of the Sunderland Corporation is being extended and equipped with turbine machinery, with a view to meet the increased requirements in electrical power of some of the larger shipbuilding and engineering firms in the district. Messrs. John Lynn & Co., of the St. Luke's Engine Works, Pallion, are still finding it necessary to work overtime.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

The Ship Canal.—The half-yearly meeting of the shareholders of the Manchester Ship Canal Co. was held on the 8th inst. The total expenditure on capital account up to date reached the sum of £16,567,881, with a credit balance of £1[illegible]8,8[illegible]. The revenue receipts totalled £248,333, and the expenditure £134,708 leaving a credit balance of £113,625. The profit on the Bridgewater undertaking was £17,408. The weight of toll paying merchandise which passed over the Canal during the six months ending June 30 was Sea borne traffic [illegible],583 tons, barge traffic, 13[illegible],200 tons; total 2,40[illegible] [illegible], as compared with 2,243 138 in the corresponding six months of 1906. The receipts showed an increase of £15,157. The profit on the Bridgewater department amounted to £1[illegible],408 against £18,258, a decrease of £850. The deepening of the length of the Canal from Latchford to Irlam has been completed and the work of deepening the remainder is making steady progress. The mooring dolphins above Latchford locks are now finished. The leading jetty below the central pier at the Irlam locks is completed. Other like works and railway sidings at Partington and at Trafford Park Junction are in use. The Customs Office at the Manchester Docks is completed.

The Chairman (Mr. J. K. Bythell) told the meeting that for July the receipts were more by £3000 than for the same month last year. Like the railways, they had to face considerably increased revenue expenditure. Their labour bill would be considerably larger. Employers had been granting concessions to workmen, and the Ship Canal had to follow suit, and, in the aggregate, these concessions considerably increased the cost of working. Their coal contracts had nearly rnn out, and contracting for another year's supply would mean an increased expenditure of £10,000. In view of the increased expenditure and competition, they must not expect that the annual increase of net revenue would be much, if any, greater than in previous years, unless there was a great change. If all the local importers and exporters could be induced to take the same interest in the Manchester port as the importers and exporters of Liverpool and Bristol took in theirs, the progress would be greatly accelerated. The Company was quite ready to receive the tolls of passenger steamers running pleasure trips on the Canal.

Cotton to Manchester.—The cotton season is now closed. With 28,314 bales which arrived indirectly, the imports amounted to 456,852 bales, as against 338,473 last year, and 533,044 in the previous year. This return relates to American. The Egyptian service of cotton was the best on record, over 220,000 bales being received, as compared with 211,091 at the corresponding period last year, and 177,750 in the preceding year.

Ships' Cargo Gear.—Experiments are now being made with electric winches on board coasting steamers. They are driven by current generated by oil engines and dynamos direct coupled. Economy is aimed at. Such steamers spend several days a week in port, and, instead of the boilers having to be kept at work all the time in port to keep the winches going, the fuel consumption will be limited to the actual time the work of loading or discharging is in progress.

Increased Water Communication.—The annual report of the North Staffordshire Chamber of Commerce favours the proposal of two main channels across England, one from the Humber to the Severn, and the other from the Thames to the Mersey. To begin with, the Chamber would like to see the river Weaver extended to the Birmingham neighbourhood *via* the Potteries, or even a smaller scheme, beginning by extending the Weaver from Winsford to the Potteries, a distance of twenty miles. They believe that if a canal were constructed, which would pass sea going craft up to the Fens, the cost of transit would be reduced very considerably. To raise the money locally is regarded as an impossibility, and the advisability is urged of the Government guaranteeing the necessary money. New or improved main canals should be under a Government trust, if it can be shown that there is a reasonable prospect of a fair return for the outlay.

Dockizing the River Mersey.—Considerable discnssion has taken place in Liverpool as to the desirability of barring the mouth of the Mersey at New Brighton and providing an outlet to the sea through the Great Float at Birkenhead and the Leasowe Embankment. The scheme is not new. It has often been talked about. Formerly the silt brought down by the river and its tributaries would have given considerable trouble, but now it is only a river by courtesy, the Manchester Ship Canal having mainly absorbed the river. From an engineering point of view, the scheme presents no great difficulty; it is a question of cost. Against the capital expenditure, however, it is to be borne in mind that to make the Mersey an inland lake would save a large annual sum in the lighting and deepening of the long channel to the bar. Dock gates would no longer be required and port dredging, it is said would practically disappear; no new enclosed docks would be required; mere piled piers would suffice. It would then be possible to reach Liverpool and the entrance to the Ship Canal at Eastham, irrespective of the condition of the tide.

Rochdale Canal.—The exceedingly wet weather of the past few months has had a deterring effect on the prosperity of the Rochdale Canal Co. Half the Company's horses have suffered from "Pink eye" disease, and prior to that the

canal was obstructed by ice and the towing paths by snow-drifts. Tolls, however, showed an increase of £129; the receipts from freight were practically the same, and traffic expenses were increased by £634. The net balance left was £4096, a decrease of £382. More boats were wanted to deal with the abnormal traffic suddenly thrown upon the Company, such as it had been during the past half year. The development of motors as an alternative to steam and horse haulage was being watched, but up to now no motor quite satisfactory has been offered.

A New Dredger for the Mersey Bar.—The Mersey Docks and Harbour Board have accepted the tender of the Tranmere Bay Development Co. for the construction of a new twin-screw self-propelling 10,000 tons sand-pump hopper dredger, for work at the Mersey bar. It is claimed for this vessel that she will be able to fill herself with 10,000 tons of clean sand in fifty minutes from a maximum depth of 70 feet.

Manchester Iron Market.—Manchester iron market has been slowly and slightly declining in values during the month. The demand from abroad has, however, continued good, and sellers here are not disposed to favour English consumers over much. Buyers, also, wondering how long the export trade is to continue on its present dimensions, only buy sparingly. Hæmatites practically show no decline in prices—none in fact on the east coast, and but little laxity on the west. The engineering industries of the county remain fairly well employed. Large orders have been received for locomotives for New South Wales, and remarkable profits have been made by several of our textile machinists.

Lancashire Coal Trade.—There is only one thing to be said about the coal trade of Lancashire, *viz.*, that it is enjoying a period of great prosperity. The weather this summer hitherto has rendered house fires a necessity. There has been little or no falling off in the demand and no reduction in prices. Coal for steam purposes is in greater demand almost than can be supplied. No stocks worth speaking of are accumulating, and prices keep up at the full advance previously recorded in these columns. The volume of trade done at the coal tips on the Ship Canal at Cadishead and Partington is greater than ever. Additional tips are spoken of in the near future. The total weekly coal shipments average between 20,000 and 30,000 tons. Most of the coal sent from these tips is from Lancashire collieries, but the Yorkshire and Derbyshire coalfields share in our export trade. There is no change in prices on the Manchester Coal Exchange from those published a month ago. The operative coal miners are receiving another five per cent. advance on the 11th September. An advance in the prices of steam and house coal is expected at the time of writing.

THAMES.

(From our Own Correspondent.)

The London Dock Question. It is now announced with some show of authority that the Government has definitely decided on bringing forward a measure next session to deal with this matter. The Board of Trade is the department charged with the framing of the measure, and it is believed that in the new port authority the leading control will be put in the hands of those that are to pay the dues, *viz.*, the merchants and shipowners, the public bodies concerned having due representation. The extension of further facilities will include the deepening and widening of the channel, and improving the berthing, discharging, collecting and distributing but the arrangements are said not to include any compulsory purchasing of the docks. The dues to be levied on goods or ships or both will be utilised for improving the river, but not for purchasing the docks and there will be no Government subsidy. It is considered probable that the lines followed will be similar to those controlling the Mersey Dock and Harbour Board, which represents those paying tolls, dues and dock rates and which is well known to be a very successful organization.

Dock and Shipping Reports. This is the season when companies hold their half-yearly meetings, and among them we have reports from the London and India and Millwall Dock Companies, both concerned very much in the question above referred to. Naturally, the more powerful of the two speaks with the louder voice and the directors have paid visits to the Continent and seen the great docks there, but their reply is that conditions are so dissimilar that Hamburg and Antwerp cannot be compared with London in this connection. The Company recommends either the Liverpool model or that put forward by themselves in a bill and now withdrawn in view of the Government measure that is forthcoming. Turning to the reports proper, the London and India Dock Company shows a 34,000 increase of tonnage in the past six months, with a balance of profit of £25,000 more than at this time last year, which, of course, shows the docks are by no means on their last legs. The Millwall Dock Co., a much smaller concern and with a different class of trade, does not show to the same advantage over the same period last year, though the tonnage had increased. The falling off in Russian business is primarily responsible for this state of things. The Regent's Canal is another company which remains in about the same condition as last year and pays the same dividend. The British Steamship Investment Trust has a very favourable statement to make, there being a balance to the good of £32,951 after full allowances are made for depreciation and the outlook is described as hopeful. The "Shell" Transport and Trading Co., Ltd., distribute a 10 per cent. dividend and have a very satisfactory report to publish.

Woolwich Arsenal Employees.—This question has been very much to the front by reason of the discharges that have been going on. Questions have been continual in the House of Commons on this matter, till we now know the minimum has been fixed at 8,000 hands and that no more discharges will take place after September, as it will be left to natural wastage to get down to the required numbers. The figures do not include those employed in the torpedo factory and building departments, which gives a total at Woolwich, 12,311 men. Another change contemplated in this connection is the removal of the torpedo factory entirely to Scotland, where opportunity for tests present themselves that are lacking at Woolwich. This will occur in the next twelve or eighteen months, it is said. The question of a strike has been mooted, but good sense prevailed, apparently in view of the inevitable, as, of course, there is no work for the Arsenal in view of present peace conditions prevailing. Many of the men have emigrated, mostly to Canada.

Thames Steamboats.—Now that the novelty of public owned boats has worn off, there is a continual decreasing traffic to report. The weather, too has not been favourable hence, what is essentially a pleasure service suffers in consequence. Up to July 20th from the beginning of the season, there is a decrease of nearly £2 000 in the receipts as compared with the same period last year and a falling off of over 400,000 passengers. This is for a period of nine weeks. The figures speak for themselves, and show that with the competition of railways and trams, a steamboat service cannot, except for a limited few weeks of fine weather pay its way and that express steamers tried stopping at few piers only accentuate the expenditure without in any way adding to the gross receipts.

London Steamship Rates.—Owing to the rise in the price of fuel and other commodities, the Companies trading to the East have given notice of a surtax to be put on of 10 per cent. to current rates. The movement is a big one and practically includes all lines trading in the direction named, the P. & O., the British India, the Ellerman, the Orient Co., the Aberdeen Line and others, with many foreign companies. The action is due to the fact that the companies have long voyages and have to bunker as they go along at the different stages of the journey. The Australian authorities are up in arms over the matter and even talk of prosecuting the companies under the Anti trust laws. The associated lines, however, form a very powerful combination and threats are likely to be of little avail.

Franco-British Exhibition, 1908. From the syllabus published of this forthcoming exhibition to be held at Shepherds Bush, we can gather that engineering will take a very prominent position At the head of the group of engineering and shipping is Sir W. White, and the different sections include shipbuilding and shipping with the names of Dr. Elgar and Mr. Jas. Dixon chairman of Lloyd's Register associated in each case. We therefore see from this fact alone that the branch we represent is likely to be well to the forefront, and from the other departments of engineering in combination we may

expect an all-round good display from our own and our neighbour across the Channel and their abundant stores.

Thames Training Ships.—As is well known, there are several of these vessels on the Thames and prize days have been a feature lately. The *Worcester* probably leads and at this gathering Sir Thos. Sutherland took the chair. Some 350 friends journeyed down the river from London Bridge by boat on this occasion and a feature was a letter from Admiral Togo to the captain, together with the latest photograph of himself; of course, it is well known the Admiral was trained on this vessel. A different class of vessel is the *Exmouth*, under the Metropolitan Asylum Board. At present there are 552 boys under training, most of whom join the Navy, the mercantile marine or the Army as musicians. The healthful character of this life must be a good basis upon which to work and encomiums were general on the system adopted here. The *Warspite* is to send 50 boys in the autumn to Australia in the four-masted barque *Port Jackson*, but this time some 30 other cadets will be on board, it is understood. The former experiment was so successful, however, there is little doubt that the forthcoming one will be also.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—The past month has been uninteresting in the sense that it has brought no new orders for new vessels, and some of the business which was expected here has gone elsewhere. The fact is that there is at the moment very keen competition for orders, and there are not too many of them. Locally there has been no cutting in prices, but it is evident if the present policy in the shipbuilding trade is maintained local firms will begin to cut as well, as that will really be the only way to get their fair share of work. It is not true that Vickers, Sons & Maxim expected the order for the new sand-pump dredger which has been given to Cammell, Laird & Co., because it was known that this important Liverpool order was being competed for by the Mersey firm, and also by builders on the Clyde, who make a speciality of this class of work. Barrow builders, however, have provided the Mersey dock and Harbour Board with the three last sand pump dredgers, which have done such important work in dredging a deep water channel into the great Lancashire port, but, of course, that is no reason why the order should go past a Birkenhead firm which is now well equipped for this and other classes of work. The intimation that the order has been given to Armstrong, Whitworth & Co. for two large and powerful cruisers for the Argentine Republic caused some disappointment in Barrow, because the yard is fairly empty of important orders, and the Tyne yard where the order is reported to have gone to is as full of work as can be. It is quite reasonable to think that a yard so splendidly equipped as that of Vickers, Sons and Maxim cannot go for long without some big orders engaging the attention of the masters. Too much capital is involved for this and it is understood a special effort is being made to get new contracts of some importance to follow those which are now receiving attention. This is necessary in regard to the maintenance of activity in the shipbuilding department. In other branches of their business builders are very fully employed, and are likely to remain so for some time. The firm is so large and its ramifications so numerous and comprehensive, that a great deal of orders are necessary to keep all departments in full employ and it is not always possible to get these just when they are wanted.

The Russian Cruiser "Rurik."—Vickers, Sons & Maxim are now busy completing the cruiser *Rurik*, the largest and most powerful cruiser yet constructed. This vessel has been out on her trials, which were very satisfactory up to her full speed trials, when her bearings heated, and it was found necessary to bring the vessel into port again for new bearings. It is expected to get twenty-one knots speed very easily, and her preliminary trials all indicate that she has the requisite power to go at even a greater speed than this. She is now out in Morecambe Bay doing her trials, and she is expected in port again to be completed before being handed over to the Russian Admiralty. She will prove a great acquisition to the Russian Navy, but it is expected she will be only one of a class, and that orders for other vessels of the *Rurik* type will be given out at an early date either to Russian or British yards. The vessel has been built under the careful and efficient inspection of Russian experts, who know what they want and take care to get it. Some of these officials are very smart men, and they have a greater knowledge of their work than most people would give them credit for.

Peruvian Cruisers.—News is to hand of the safe arrival of the *Almirante Grau* and the *Coronel Bolognesi*, built at Barrow for the Peruvian Government out at Callao. These new additions to the Peruvian fleet have been much admired on the West Coast of America, and it is probable they will be the forerunners of other and more important orders for the resuscitation of the Peruvian fleet.

Work in Hand.—The work in connection with the Brazilian warship at Barrow is proceeding very satisfactorily at the Barrow yard, and the building of the three steamers for the London and North-Western Railway Company is making progress. The Mexican transport steamer is also well in frame. Much attention is still being devoted to the construction of submarines for the British Government. The report was circulated the other day that at the Barrow yard submarines were being built for other Powers. This requires confirmation. This is a department of the Company's business which is kept, and rightly so, under close camera, and as the vessels are all being built in a special shed under cover nothing is known until a vessel is launched. Recently several submarines of the C class have been delivered to the Admiralty, and others will soon be ready. The work of constructing the first of the D class of submarines is now proceeding. It is understood it is a much larger vessel than any yet designed and launched, and that other submarines of the same class will follow if after trial it proves as satisfactory as is expected. The question was asked in the House of Commons a few days ago as to why it was that all the orders for submarines were given out to Vickers', and the reply was that this firm had devoted very great attention to this subject. It might have been added that the Vickers' firm hold the patent for the Holland submarine, which has been adopted by the Lords of the Admiralty, and which has from time to time been improved and the improvements have been also patented. Of course, the Admiralty are ready to receive designs from other firms, but the Vickers' firm have a good start in the experience they have gained with the Holland boat.

Engineering.—The engineering trade is very busy. It is reported that the order has been placed at Barrow for the turbine engines of the two cruisers required by the Argentine Government. The marine department is well off for orders in the marine and the gun-mounting departments, and it is likely that this activity will be maintained for some time to come.

West Cumberland.—A steady run of work is reported from the West Cumberland district, and both at the Workington and Maryport yards a number of small craft are being built. Builders seem to have no difficulty in securing orders for small vessels, and they deliver quite a number every year.

Shipbuilding Material.—The demand for shipbuilding material is not so brisk as it has been, and the mills are at present only on half time, but this is quite a temporary arrangement, as makers have been waiting for specifications on the one hand, and they have had to suffer to some extent in consequence of the Belfast strike, and the difficulty in delivering material. Heavy plates are at £8 per ton net cash.

Hæmatites.—The hæmatite trade is very brisk, and there seems every indication of a shortage in supplies. Mixed Bessemer Nos. are at 80s. 6d. net f.o.b., and warrant iron is at 78s. 4½d. net cash. Warrant stocks have dwindled down to just over 11,000 tons.

Shipping.—The shipping trade is well employed. The exports of pig iron and steel this year have reached 581,566 tons, being an increase on the corresponding period of last year of 74,545 tons.

SOUTHAMPTON.

(*From our Own Correspondent.*)

The "Swietlana."—Messrs. J. I. Thornycroft & Co., Ltd., have recently constructed a 70 ft. motor yacht, and the following is a description of the vessel and machinery. The vessel is a shallow draught twin screw motor yacht, the principal dimensions are:—Length overall, 77 ft. 6 in.; length on water line, 70 ft.; beam, 13 ft.; depth, 4 ft. 9 in.; draught loaded with 2·5 tons, 2 ft.; speed, 12 miles per hour; B.H.P., 100. There are two Thornycroft standard four-cylinder 6 in. by 8 in. motors running at 800 revolutions per minute, fitted with Thornycroft screw reversing gear and driving twin three-bladed propellers of the Thornycroft pattern. The ignition is of the magneto type. There are two large fuel tanks at the sides of the motor-room and a smaller gravity feed tank overhead. An organ whistle is provided, worked from the exhaust gases in the silencer, and the motors are arranged to run on either petrol or petroleum. The vessel is built of galvanized steel in three sections for transportation, the total lifting weight being only 17½ tons. There are two tunnels for the propellers and two balanced rudders. The cabins, which extend for 58½ ft., are of teak with sliding glass windows and sliding jalousie shutters. The motor-room is a little aft of midships and immediately forward of it is the galley, while from the galley forward are the owner's suite consisting of large saloon, two state rooms, a bath-room and w.c. and pantry. Aft of the motor-room is another saloon and w.c., while further aft is the crew space. The cabin top forms a promenade deck, which is railed round, and on it are situated the steering wheel, telegraph, silencer-funnel and two sparred deck seats. The vessel has a clipper stem with carved scroll and small bowsprit, which give it a very smart appearance, and as will be gathered from the above particulars the builders have been enabled with their wide experience in this class of work to turn out a very handsome and speedy vessel with a very light draught of water, which, as stated above, is only 2 ft. loaded with 2½ tons. The yacht has just completed her trials in Southampton Water, and a mean speed of 12½ miles per hour was attained.

The Motor Yacht Club held their annual reliability trials during August in Southampton Water, and out of an entry of sixteen, fourteen vessels started. The yachts, launches and other sea-going motor boats not exceeding 30 ft. overall numbered eleven, whilst there were three competitors only in the open class for sea-going motor vessels. The trials extended over two days, and on the first day there was a very choppy sea, but on the second the conditions were much better, and at the end of the day's run it was found that no single boat had dropped out and that ten out of twelve completed the full ten hours' running without a single stop, whilst eight went through both days without delay of any sort. On August 2nd the race for the British International Cup took place. The cup was won last year by Yarrow Napier, jointly owned by Lord Montagu and Mr. Lionel de Rothschild, and the challenger was the American boat *Dixie*, entered by Mr. E. J. Schrœder, of the Motor Boat Club of America.

Daimler II., *Daimler I.* and *Flying Fish* also entered. The cup was won by the *Dixie*, and the average speed was 27·6 knots per hour, the *Daimler II's.* speed being 27·1. The total distance traversed by the competitors was 35 nautical miles.

The New Southampton Dock. The Directors of the London and South Western Railway have accepted the tender of Messrs. Topham, Jones & Railton, Ltd., Great George Street, Westminster, for the construction of the new open dock here. The dock will be the deepest open dock in the world, and will have a normal depth of 40 feet, and will thus be able to float, at any state of the tide, not only the largest vessels in existence, but all at present building or contemplated for many years to come. The two main quays will be 1650 feet long. The width of the dock will be 400 feet, and the length of a third inner quay owing to the angle at which it is to be built will be 640 feet. In addition to the three inner quays there will be two outer quays in the vicinity of the new Trafalgar Dock, and these will be 405 and 515 feet long respectively. The dock will have its outlet on the river Test side and will be situated between the Trafalgar Dry Dock and the Cold Storage Buildings, and will be 16 acres in extent. Messrs. Topham, Jones & Railton have gained a high record in connection with great marine undertakings, and have successfully completed for the British Government the extensive docks and harbour at Gibraltar, costing nearly £4,000,000, as well as the new docks at Cardiff, opened by the King last month, and are at present engaged upon the King's Dock at Swansea. We understand the construction of the new dock will involve the expenditure of half a million sterling. The site for the dock has already been cleared and the work of construction will be commenced forthwith.

New Electric Cranes.—Messrs. R. & J. H. Rea, of the Rea Shipping and Transport Co., Ltd., are putting down a large electric coal handling plant at the Coal Dock here to replace the present hydraulic plant. The installation will comprise two gas producer plants by the Mersey Engine Works Co., of Liverpool—two large 150 B.H.P. gas engines (vertical Westinghouse type) and dynamos and a large storage battery. Four electric cranes are being erected on the wharf by Messrs. Appleby & Co., and the motors and electrical equipment are by Messrs. Siemens Bros. and Co. The plant is expected to be working in about two months' time, and we hope to give a detailed description of the whole installation in one of our future issues.

BELFAST.

(*From our Own Correspondent.*)

The Strikes.—The shipbuilding and engineering firms suffered to a very considerable extent from the carters' strike, owing to their being unable to get delivery of material. Fortunately, however, this trouble is now a thing of the past, a settlement having been arrived at between the masters and men on the 15th of August. Both sides made certain concessions. The master carriers have agreed to a rise of wages; but, on the other hand, they have gained what were really the two most important points of contention, namely, that they should be allowed to employ whatever men they choose, whether union or non-union, and that the employees should cart to and from the steamers affected by the dockers' strike, *viz.*: the Fleetwood, Heysham, Barrow, and Belfast Steamship Companies' vessels. This labour war has done incalculable harm to the city. An enormous amount of trade has been diverted from Belfast, a very considerable proportion of which will in all probability never be recovered.

It is not necessary, nor is it advisable to deal here at length with the rioting which took place in the Nationalist quarter of the city, and which, unfortunately, though unavoidably, resulted in the loss of life. The action of those in authority in ordering the military to fire upon the rioters has been condemned in certain quarters from which only condemnation was to be expected. But those who have lived in Belfast and know something of the savagery and brutality of such a mob, strung up to a frenzy of political fanaticism, and filled with hatred of law and order as represented by the servants of the Crown—for these riots, though having their origin in the strike, were undoubtedly political—know that the firing was entirely justifiable. The dockers' strike still remains unsettled, but, so long as the discharging of the various steamers can be carried on as it has been by imported labour, trade will not be to any great extent interfered with. At time of writing a conference is in progress with a view to adjusting the differences between the coal heavers and their employers. This trouble was referred to in last month's notes, and since then the strike was settled. The merchants, however, allege that the conditions of settlement are not being carried out. Just after last month's issue had gone to press, a settlement of the ironmoulders' strike was come to, the men agreeing to an advance of one shilling per week, instead of two as demanded.

Messrs. Harland & Wolff will shortly put in the water from the south end of their yard another fine twin screw mail and passenger steamer for the Royal Mail Steam Packet Company. The next launch after this from their yard will be that of a big oil barge named *Na·ahoe*, for the Anglo-American Oil Co. The oil-tanker, *Iroquois*, built by them, and at present being completed at the fitting-out wharf, will have a special towing fixture, as it is intended that she shall,

when required, tow the *Navahoe*. The Hamburg-American liner *President Grant*, built at the Queen's Island, will shortly be ready for sea. Messrs. Harland & Wolff, not being connected with the Employers' Federation, will not, of course, be affected by the impending shipbuilding crisis.

Messrs. Workman, Clark & Co.—On the 16th of August, this firm launched from their South Yard the fourth of nine vessels ordered from them by the Lloyd Brazileiro of Rio de Janiero. This latest addition to the fleet, which has been named *Rio de Janeiro*, is 356 feet in length, with a gross tonnage of over 3,500, and is intended for passenger and cargo trade between the principal ports of the American continent. The propelling machinery consists of two sets of triple-expansion engines supplied with steam by three large boilers fitted with Howden's forced draught system. Messrs. Workman, Clark & Co. have several other large vessels nearing the launching stage. Should the threatened lock-out in the shipbuilding trade take place, it is probable that this firm will not be required to fall in line with the other firms in the Federation, as they have already suffered serious loss through the Belfast strikes.

Harbour Items.—The Belfast Harbour Commissioners have decided to expend a sum of £15,[illegible] in widening the quay at the south side of the York Branch Dock, and in erecting new storage sheds on this quay in place of those recently destroyed by fire, to which reference was made in last month's notes. At the last statutory meeting of this Trust, the harbour master (Captain Molyneux) reported that the total tonnage of vessels arriving in the port from 1st January last to 17th August was [illegible] tons. Compared with the same period last year, these figures show a decrease of over 33,000 tons, entirely due to the unfortunate strikes above referred to.

Since writ[illegible] the Employers' Federation and the Be[illegible]

JUNIOR ENGINEERS.

XII.*

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Moulding *(continued)*.

WHEN several castings are required from one pattern it is of considerable advantage and a saving in time and labour to use a moulding machine, in the simplest form of which the sand is rammed by hand rammer in the usual way round the pattern. This machine is mounted on a stand to bring the table to a convenient height for the moulder to work at, and may either be portable or fixed for small castings. The table is accurately planed or milled, and to suit the size of the moulding box the centre part is cut out and made movable vertically. On this, the half pattern is secured by pins screwed into it, and by means of levers and guides worked by the operator at will, it is capable of movement downwards from the table, on which the box containing the mould is fixed. The method of making the mould is similar to that by means of the ordinary box save that the pattern is firmly secured to the movable plate and brought up flush with the table plate, on which the moulding box is then placed, clamped and the sand filled in round the pattern and rammed home. The plate with the pattern on it is then drawn down clear of the table and the moulding box lifted and reversed, when the mould will be found clean, requiring little or no touching up by

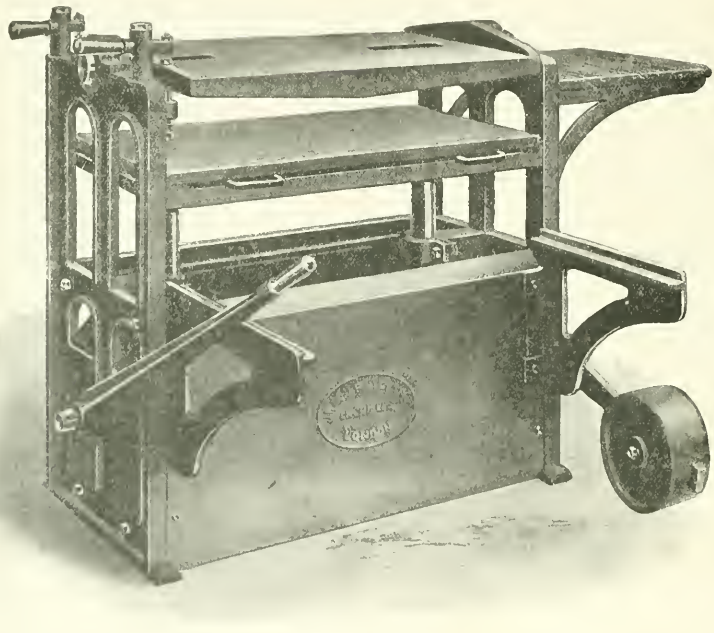


Fig. 1 Moulding Machine.

* For Articles I. to XI. see last eleven issues.

hand tool. This style of machine is only suitable for a certain class of castings, the patterns for which admit of being drawn downwards from the mould. In another style the operation is reversed, where the moulding box is drawn away from the pattern. By the use of these machines the time saved is considerable, the direct and steady draw of the pattern from the mould, or of the mould from the pattern as the case may be, results in clearly defined unbroken edges, while in the hand moulding boxes, owing to the difficulty of lifting the box by hand evenly and steadily, the corners and edges are frequently broken in parts, necessitating skilful manipulation by the moulder with hand tools. The hand ramming of the sand to the pattern is preferred in some foundries, but to save time, machines are made and largely used throughout the kingdom where the ramming is done by mechanical means, pneumatic or hydraulic power being generally employed. The power moulding machine is made to take in a larger range of sizes than the hand machine, so that to provide for a larger variety of patterns one of the former may serve in place of several of the latter. A pneumatic power machine requires a foundation to keep it steady. It consists of a foundation sole plate, to which are bolted side frames projecting high enough to carry a strong cross frame, which can be adjusted to any range of heights required, within limits On the sole plate are fitted the power cylinders with pistons, to the heads of these the moulding box is secured. Operating valves are fitted on the frame of the machine in a convenient place. The sand box for filling the moulding box is conveniently placed. The pattern plate on which the pattern to be moulded is secured is limited by the size of the box which the machine can take in, and they are made to include a 3 ft. 6 in. box. The moulding box with the pattern on the pattern plate is filled with sand and brought into position on the machine, when the admission valve is opened and the pistons operate to push the box up to the rammer overhead, which presses the sand equally over the pattern, and the mould is made. The valve is then shut and the exhaust opened, when the box gradually comes down again, and it is ready for drawing the pattern; this is effected also by the machine, a carrier being brought along to receive the pattern plate, which is then set free and the carrier receives it. The pattern in this case is drawn from the sand in the box, thus leaving the mould, a style which is preferable to the box being drawn from the pattern, when it can be so arranged.

For deep castings where the direct power ramming would not prove effective in obtaining a firm mould throughout, a special machine has been designed in which the sand is jarred down, the motion being applied by pneumatic vibrators to the box.

A handy machine fitted with hydraulic power, supplied by Messrs. J. W. & C. J. Phillips, of Leeds and London, is illustrated in their F Catalogue, showing the rammer or presser swung away from the table on which the moulding box rests, the box being ready for lifting after the pattern is drawn. The hydraulic pressure required is 750 lbs. per square inch, and for a table of 18 in. diameter, giving an opening of 12⅞ in. diameter, the total pressure on the mould is thus five tons.

A more elaborate machine operated by hydraulic power, Fig. 1, supplied by the same firm, is specially designed for repeat work, and takes two moulding boxes at a time, the pattern plate serving also as a parting plate, the pattern being repeated on each side. The hydraulic piston presses the sand into the boxes at a pressure of 900 lbs. per square inch.

A portable machine for small patterns is made for hand ramming with the pattern plate fitted on brackets, which admit of it being rocked over from the moulding box to the back, after the mould has been made. The weight is counterbalanced by springs, and the operations in connection with the placing and fixing of the pattern plate, the moulding box, the ramming, closing up, rocking over and drawing the pattern all admit of ready accomplishment.

"Koster" Patent Air Compressors.—Amongst the orders recently received by W. H. Bailey & Co., Ltd., Albion Works, Salford, Manchester, for their "Koster" patent air compressors, is one for the South-Eastern and Chatham Railways, capable of dealing with 60,000 cubic feet of free air per hour, and another for the Daimler Motor Co., Ltd., Coventry, to deal with 14,000 cubic feet per hour.

REVIEWS.

In the First Watch. By Jas. Dalziel. London: Fisher Unwin.

IN this book the author has produced a series of yarns in connection with the engine-room and sea-going life, which will be read with interest, if not with enthusiasm by engineers, and especially by those whose lot has been cast in Eastern waters, and more immediately in the region of the China seas. The pathos in some of the incidents narrated is implied rather than expressed, thus giving a charm to the imagination of the reader to work upon according to the sentiments of his nature; in others it is both realistic and tragic, leading one to wish the end were otherwise than as portrayed, but as in real life honest effort and endeavours do not always command the success deserved by reason of the antagonism of others, so we must accord to the author that the preservation of verity is better. Mr. Dalziel has brought the engine room into a region of literature where it has been hitherto almost a stranger, and we have read with pleasure the introduction of the starting platform into the area of romance. The introduction of technicalities necessarily involves the comprehension of an engineer to follow the course of some of the incidents, but others are sufficiently clear to the non-technical mind to be understood and appreciated, and they will be appreciated by the chums of engineers, whether of one sex or the other.

The Distribution of Electrical Energy. By J. F. C. Snell. Sunderland: Thos. Reed & Co. 1907.

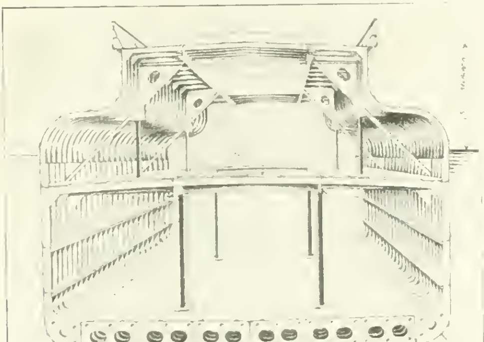
THIS is a handsomely got up book with 169 illustrations, which opens with the relative economics of different systems of distribution, and when we say it is the outcome of a paper read before the Institution of Civil Engineers, it may be gathered that some considerable knowledge of the subject would be required by a reader. In designing a distributing plant the question of the quantity of copper used is an important factor, and this is what the author shows in his introduction. The question of overhead transmission lines is discussed first, with the principles governing insulation all amply illustrated. Then the poles employed are dealt with closely and graphically with the Board of Trade regulations concerning the same. The second part relates to underground cables with the methods of preparing them fully described. The troughs necessary for laying the cables in are closely considered, with all the connections to houses and by subways. When in place there is the testing to be done, and this is all fully gone into here. In Part III. we are directed to sub-stations with the different types of transformers and motor generators. Following on we have the materials employed in manufacture of cables, chief of which is rubber for insulation purposes. Next the different systems of distribution are discussed, with the conduits used, and up to this point the general method of laying street cable is treated. Next we have such cases as collieries and mines, with the rules connected therewith. Tramways have a special section to themselves here, and the rules appertaining thereto. Railways are made a feature of, and a section is that of shipyards and large works generally, not very full however, while Part VI. is devoted to distribution within buildings and some practical formulæ given. From the above it will be seen the author's aim is to give a *resumé* of electrical distribution as it affects various cases, and what these are will be gathered by the enumeration we have made, which are the results of the author's own practical experience.

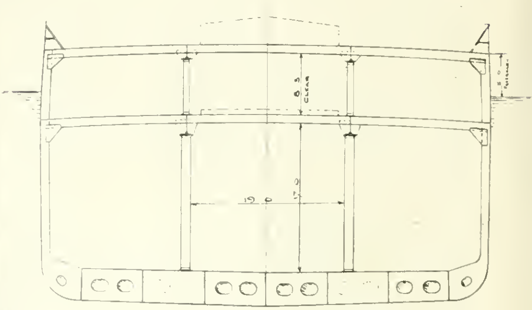
S. T. Taylor & Sons, of Newcastle-on-Tyne, have covered the boiler bottoms on the steamship *Acre* with their "Tynos" patent removable asbestos mattresses; the boilers, pipes, etc., on the steamships *Arizona*, *Ryhope* and *San Giovanna* with their "Tynos" non-conducting material, and in connection with the steamship *Venezia* they have carried out a large amount of work consisting not only of covering the boilers with their "Tynos" asbestos mattresses and pipes with "Tynos" non-conducting material, but they have built and insulated throughout the rooms for storing provisions, etc., with full equipment. This is the second job they have had in hand for the same owners, the previous steamer being the *La Madonna*.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Clan Graham.—On July 24th there was launched from the yard of Messrs. William Doxford & Sons, Ltd., Sunderland, the first of a series of improved 'tween deck turret steamers, building for the Clan Line Steamers, Ltd. She is constructed on Messrs. Doxford's latest improved method of internal construction, with clear 'tween decks all fore and aft for general cargo work, and the construction of the 'tween decks provides exceptional advantages for stowage of large goods, especially such as railway rolling stock, including passenger rolling stock, all of which necessitate large open spaces for stowage. The system enables this vessel to carry more than three times the quantity of such high value freightage usually accommodated in the ordinary type of ship, the methods of constructing ordinary vessels leaving only the lower holds forward of the machinery space of sufficient height for such goods, the after holds being obstructed by the shaft tunnel, and the 'tween decks being too low. Great advantage is therefore obtained in this improved turret construction, for in addition to the stowage in the lower holds as usual, she has clear space all fore and aft in the 'tween decks, measuring in cross section, 30 ft. wide and 16 ft. high, as illustrated in the annexed sketches. This steamer therefore, marks a great advancement in earning powers. She is designed to carry 7,800 tons and steams 11 knots loaded, being of fine lines and heavily powered, and fitted with Howden's forced draught. S. T. Taylor & Sons, Newcastle-on-Tyne, have covered boilers, pipes, etc., with their "Tynos" non-conducting material. She was named the *Clan Graham* by Mrs. Harold, of London.





Sir Charles Cayzer on the occasion of the launch of the above vessel, said in the course of his remarks: "Sir Theodore informs me that he has said as little as he possibly can about the ship, because he expects me to speak on her good qualities. I think this is looking far ahead, seeing she has only just been launched, and we can only take her good qualities from the reputation that we have of her builders, as in all former cases of vessels built by them for us they have been quite reliable. This vessel will be a great advancement on anything that they have built for my line, and I hope it will prove so, but it strikes me why these advancements by shipbuilders and engineers cannot be made at once? They are constantly advancing in type of vessel, yet it seems to me they are rather selfish in not bringing these advancements out all at once. They knew the great difficulties that we, as shipowners, have to contend with in earning our living, and sometimes losing a portion of it, and yet they tantalize us with knowing that in the advancements we are going to get something better, and that she will be able to earn more money. I would have been more grateful to them if they had given us them all at once. However, we have to take things as they are. To come back, we hope that this vessel will be a great advancement on anything that they have previously built for us. I believe the number now is 28 and our present order will make 30, with a carrying capacity of 250,000 tons. Considering that these vessels make an average of three to four voyages a year, and can carry 250,000 tons, anybody can find out how much cargo we can lift for the benefit of the public only, and what little we get for ourselves for that gigantic operation. The improved method of construction of this ship lies in doing away with cross beams. I think it is something like a bridge with beams from one side to another; and having done away with these cross beams, they necessarily have to put something in their place. It is a most simple thing to do. We shall be able to carry three times more of bulky cargo than we did in the former vessels. Now I hope this is right. See how much they handicap us in the ships they have already sold, and which are paid for. This space now is 30 ft. wide and 16 ft. high, and we shall be able to carry three times more cargo, which consists of heavy railway rolling stock. You may be rather surprised to know that this new vessel can carry a whole train, like those which take us to London, saloon and carriages; we can put them all in without detaching them at all; and there is a tendency of the railway companies increasing the size of their rolling stock. I see by the papers this morning that the Central South African Railway Co. are building 100 waggons to carry coal to the Johannesburg mines and each of these waggons is able to carry 40 tons. Now you have all seen the coal carried about this country. I believe the waggons here only hold 8 to 10 tons each, while these waggons carry 40 tons, and they are to be 36½ ft. long and 10 ft. high, and I believe that this vessel, if we have an opportunity of taking some of these, will carry a large quantity intact, and land them in South Africa ready to carry coal the day after they arrive. That shows what shipbuilders are doing at the expense of the shipowner to improve the carriage, not only of cargo but of passengers. I don't know that in this yard they have built many passenger ships. Like myself, they carry on a high-class business, but we have given up hotel keeping, and hanging up of pictures to advertise our ships. We now content ourselves with being common carriers, and I believe as long as the mercantile trade of the world is in British hands (I don't know how long that will be, as we certainly have very strong competitors in foreigners), that with the combined efforts of shipbuilders and shipowners, we shall be able to hold our own against all comers. None knows better than myself the progress that has been made in this yard. I speak in the presence of a very eminent shipowner. . . . They said I should have been locked up in a lunatic asylum when I first came down here to order a turret vessel. Well, I have not got there yet. At any rate, I have shown my confidence in them, and I feel sure it has not been misplaced, and I only wish the other two vessels that are now being built in this yard had some more improvements in them. I have pleasure in thanking you for so kindly proposing success to this ship."

Constantinos Bebis.—On July 24th, Messrs. Short Brothers, Ltd., launched from the shipbuilding yard at Pallion, Sunderland, the steamer *Constantinos Bebis*, built to the order of Fils. C. D. Bebis, Athens. The vessel will take Lloyd's highest class and is built on the single-deck principle with poop, long bridge, and topgallant forecastle to the following dimensions:

length, 348 feet; breadth, 47 feet; depth moulded, 23 feet. An extra large quantity of water ballast is carried in the cellular double bottom and peaks, and the holds are specially subdivided by nine steel bulkheads for carrying grain cargoes. The saloon, handsomely panelled in polished oak is fitted in a deck-house on bridge deck with rooms for the owner and master. The officers and engineers are berthed in deck-houses alongside of engine casing on bridge deck and the crew in the forecastle. Six steam winches with nine derricks, steam windlass and hand and steam steering gear are supplied, taking steam from a large multitubular donkey boiler fitted on main deck. The propelling machinery will be fitted by Messrs. Geo. Clark, Ltd., Sunderland and consists of triple expansion engines, having cylinders 24 in., 39 in. and 65 in. diameter and a stroke of 42 inches with two powerful boilers of 180 lbs. pressure. Messrs. S. T. Taylor & Sons, Newcastle-on-Tyne, have covered boilers, pipes, etc., with their "Tynos" non-conducting material. During construction, the hull and machinery have been under the supervision of Mr. H. J. Richards of Cardiff. Several friends of the owners and builders attended the launch, including Mr. P. C. Bebis, of Athens, Mr. Tzoxow, of London, and Mr. Thomas Pinkney, Sunderland. The christening ceremony was gracefully performed by Miss Short, of Sea View, Sunderland.

Lord Roberts.—On July 24th, the finely modelled steel screw trawler *Lord Roberts*, built to the order of the Yorkshire Steam Fishing Co., Ltd., was launched from the yard of Earle's Shipbuilding and Engineering Co., Ltd., Hull. The dimensions of the vessel are 136 ft. 8 in. by 23 ft. by 13 ft. moulded depth and has been built under special survey, with scantlings in excess thereof for 100 A1 class at Lloyd's. To enable the vessel to fish successfully in Icelandic waters, she has been fitted complete with all the latest improvements in fishing gear, together with a turtle back forward and stern hood aft. The machinery, which is being supplied by the builders, consists of a set of triple expansion surface condensing engines, with cylinders 13 in. by 22½ in. by 37 in. by 24 in. stroke and a large boiler working at a pressure of 200 lbs. per square inch. The naming ceremony was performed by Miss Elsie Mary Murlin.

Baltic Sea.—On July 25th, Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled single-deck screw steamer of the following dimensions, *viz.*, 298 ft. by 44 ft. by 21 ft. 1 in. moulded. She is built of steel to the highest class in Lloyd's, under special survey, and has poop, bridge and topgallant forecastle; water ballast in double bottom, fore and aft and in peaks. She is equipped with patent steam windlass with quick warping ends, steam steering gear, steam capstan, four steam winches and Cochran (Annan) donkey boiler with patent seamless furnace, pole masts, and all the latest improvements for rapid loading and discharging. The accommodation for captain and officers is neatly fitted up in deck houses amidships, the engineers being in deck house alongside engine casing, and the crew in the poop. Her engines have been constructed by the North-Eastern Marine Engineering Co., Ltd., Sunderland, the cylinders being 21 in., 35 in., 57 in. by 39 in., with two large steel boilers working at 180 lbs. pressure. The vessel has been built to the order of W. R. Medhurst, Esq., of London, under the superintendence of W. C. Carter, Esq., of London. As she left the ways she was gracefully christened the *Baltic Sea* by Mrs. W. R. Medhurst, wife of the owner.

Mars.—On July 25th, Messrs. Furness, Withy & Co., Ltd., Hartlepool, launched the steel screw steamer *Mars*, built to the order of Messrs. Harris & Dixon Limited, London. The vessel exceeds 360 ft. in length, has a large measurement capacity and takes Lloyd's 100 A1 class. She is built on the deep frame principle, with single deck, poop, bridge and forecastle, with clear holds for the stowage of bulky cargo; the hatches are large and worked by six powerful steam winches, double derricks being fitted to each hatch. Cellular double bottom extends all fore and aft, the fore and after peaks being available as tanks. Wood shifting boards are fitted throughout, and a direct steam patent windlass, large multitubular donkey boiler; steam and hand steering gear, fresh-water condenser and all up-to-date auxiliaries will be included in the vessel's outfit. Accommodation for the captain and officers will be provided in large deck houses on the bridge deck, the crew being berthed in the forecastle. She will be rigged as a two-masted fore and aft schooner. The machinery will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool the sizes of cylinders being 24 in., 39 in., 66 in. by 45 in. stroke steam being supplied by two single-ended boilers, 16 ft. by 10 ft. 6 in. long working pressure 180 lbs. The vessel which has been built under the personal supervision of Mr. H. M. Rogers London, was gracefully christened *Mars* by Mrs. Levick wife of the manager of the Company.

Antinous.—On July 26th, Messrs. Robert Thompson and Sons, Ltd., launched from their yard at Southwick, the first-class cargo steamer *Antinous*, built for the Egypt and Levant Steamship Co., Ltd. (Messrs. Alfred Laming & Co. of London, managers). Her dimensions are length between perpendiculars, 346 ft. 6 in.; breadth extreme, 50 ft. 10 in.; and depth moulded, 25 ft. 6 in. She is classed 100 A1 at Lloyd's under special survey, and has been built to the three-deck rule with single deck, designed to carry a large deadweight cargo on a light draught. Ample water ballast is provided in the cellular double-bottom fore and aft, with large after peak tank. The vessel is fitted with full cargo poop, cargo bridge and topgallant forecastle for the petty officers and crew. Accommodation is provided on the bridge for the captain, chief officer and steward, with dining saloon in large house amidships, captain's chart-room and wheel-house above, under the upper flying bridge. The engineers and remaining officers, with large mess-room, bath-room, etc. are placed in steel houses breast the engine casing. There are five large cargo hatchways with double derricks fitted on tables with crosstrees at mast head, also derrick posts and derricks to the bridge and poop hatches, worked by eight powerful steam winches by Messrs. Clarke, Chapman and Co., Ltd., and a large multitubular donkey boiler by Thos. Sudron & Co., Ltd., of ample capacity for the supply of steam to the deck machinery. Steam windlass by Emerson, Walker and Thompson Bros., Ltd., and steam steering gear by Messrs. Robt. Roger & Co., Ltd. Every attention has been paid to the appliances for rapid loading and discharging of cargoes and to the ventilation of the vessel throughout. The engines, of the triple expansion type, are by Messrs. Blair & Co., Ltd., Stockton-on-Tees, having cylinders 24½ in., 40in. and 66 in. by 45 in. stroke, steam being supplied by two extra large main boilers working at a pressure of 180 lbs. per square inch. During construction both the hull and machinery have been under the personal supervision of Mr. W. H. Robson, of Cardiff.

Welbury.—On July 26th, Messrs. William Gray & Co., Ltd., launched at West Hartlepool the handsome steel screw steamer *Welbury* for Messrs. The Merryweather Shipping Co., Ltd., West Hartlepool. She will take the highest class in Lloyd's and is of the following dimensions, *viz.*, length overall, 352 ft.; breadth, 48 ft.; and depth, 27 ft. 4 in., with long bridge, poop and topgallant forecastle. The saloon state-rooms, captain's, officers' and engineers' rooms, etc. will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep bulb-angle frames, leaving large clear holds, cellular double bottom and after peak ballast tanks, seven steam winches are fitted with return exhaust, steam steering gear amidships, hand-screw gear aft, patent direct steam windlass, large patent donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead and a very complete outfit for a first-class cargo steamer. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 40 in. and 65 in. diameter, with a piston stroke of 42 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. The ship and machinery have been constructed under the superintendence of Mr. P. Bahnsen on behalf of the owners, and the ceremony of christening the steamer *Welbury* was gracefully performed by Mrs. W. S. Merryweather, of West Hartlepool, wife of the managing owner.

Excellent.—On July 27th, Messrs. S. P. Austin & Son Ltd., launched from their shipbuilding and repairing establishment at the Wear Dockyard, Sunderland, the steel screw steamer *Excellent*, which has been built to the order of James Westoll, Esq., of Sunderland. She is of the single-deck type with large hatchways specially adapted for the coal trade and quick loading and discharging, the deadweight capacity being about 3000 tons on a light draught. She will be classed

100 A1 in Lloyd's register under special survey, and will have ample water ballast capacity, so that the vessel may be able to make good passages in all kinds of weather. Accommodation for captain and officers is fitted in the poop, for engineers in bridge house and crew in the forecastle. The machinery will be supplied by Messrs. John Dickinson and Sons, Limited, deck machinery including steam windlass by Emerson, Walker & Thompson Brothers, Limited, steam winches by John Lynn & Co., Ltd., steam steering gear by Donkin & Co.. Blake donkey boiler, etc. Messrs. S. T. Taylor and Sons have covered boilers, etc., with their "Tynos" non-conducting material.

Othello.—On July 27th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 115 ft. by 21 ft. 6 in. by 11 ft. 6 in. depth of hold. The vessel has been built to the order of Mr. A. Bannister, of Grimsby and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes & Co., of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened *Othello* by Miss Nora Haynes, of Grimsby, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Rose.—On July 27th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 115 ft. by 21 ft. 6 in. by 11 ft. 6 in. depth of hold. The vessel has been built to the order of Messrs. A. & R. Osborne, of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes & Co., of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Rose* by Miss Cochrane, of Hull, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Echunga.—On July 29th, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard a fine steel screw steamer built with cantilever frames on Harroway & Dixon's, John Priestman's and Livingston and Sanderson's patents, to the order of Messrs. The Adelaide Steamship Co., Ltd., of Adelaide, South Australia, to fulfil the very special requirements of the owners' extensive coal and cattle trade. She is being built to the highest class at British Corporation and is the largest vessel yet built under the above-named patents, her leading dimensions being 404 ft. 4 in. by 56 ft. 1 in. by 26 ft. 8 in. moulded with a measurement cargo of 10,000 tons, exclusive of bunkers, on a very light draught of water, and five exceptionally large hatchways, 42 ft. long and 30 ft. wide, with perfectly self-trimming and unobstructed holds. The vessel has a complete shelter deck all fore and aft a large steel deck house will be fitted on shelter deck amidships for officers' berths, and saloon with captain's room and wheel house above and flying bridge on top of latter. The accommodation for engineers will be provided in large steel house aft, while the crew will be berthed in shelter deck aft and cattlemen in forecastle. The facilities for loading and discharging the cargo are of the most exceptional kind, and consist of two heavy masts, two crane posts and cargo span. There are six derricks and four heavy gaffs on each mast, the two centre derricks being equal to a working load of ten tons, while the four side derricks will lift eight tons each. On each gaff there will be three special gins for whipping coal and a heavy steel derrick capable of lifting twenty tons will be fitted on the main mast. To work all this gear there will be around each mast six special powerful steam winches with cylinder 8 by 12, and also four very heavy and specially designed frictional winches and two ordinary winches at each crane post making a total of twenty-five steam winches including a very heavy warping winch having cylinders 10 by 10. This winch is placed aft in deck house, and is fitted with heavy extended warping ends, and on the main shaft there are also steering chain bands fitted so that the winch could act as steering gear if necessary. The shelter 'tween decks are specially ventilated for cattle, and a complete system of cattle watering arrangement is provided both in the 'tween decks and on the shelter deck. Heavy stanchions of special design are fitted above the shelter deck to which will be attached the exposed cattle pens. She will carry the unusually large quantity of 3200 tons of water ballast, 1400 tons of which are located in angular tanks under the deck and the remainder in double bottom and peaks. She will be fitted with engines placed aft by Messrs. Richardson, Westgarth & Co., Ltd., having cylinders $27\frac{1}{2}$ in., 44 in., 75 in. by 48 in., supplied with steam by four large single-ended boilers working at 180 lbs. pressure of steam to the square inch. On leaving the ways she was gracefully named *Echunga* by the Misses Northcote twin daughters of the company's general manager at Melbourne, Victoria. There was also present at the launch a large number of friends, including Mr. C. S. Willmott, the manager for Messrs. G. S. Yuill and Co., London, who are the agents for the Adelaide Steamship Co., also Mrs. and Miss Willmott, Miss Northcote, Mr. and Mrs. Langwell, from Newcastle, New South Wales, Mr. and Mrs. Stewart, Mr. David Adamson, Capt. Dingle, Capt. Allen, Mr. and Mrs. Westgarth, and Mr. McDonald, the chief surveyor to the British Corporation on the North-East Coast. The hull and engines are being constructed under the superintendence of Capt. Charles Dingle, and Mr. James Stewart of Newcastle-on-Tyne, as consulting engineer.

Duffryn Manor.—On July 31st, Messrs. William Doxford and Sons, Ltd., Sunderland launched the steamship *Duffryn Manor*, another addition to the Cardiff-owned turrets. She has been built to the order of Messrs. Harrison, Brown and Co., Pier Head Chambers, and is designed on fine lines with a deadweight capacity of 6700 tons on a draught of 22 ft. 6 in., with very large measurement capacity, and is fitted with all the latest improvements in cargo gear; triple expansion engines and powerful boilers to give the vessel a speed of $9\frac{1}{2}$ knots. Messrs. S. T. Taylor & Sons, Newcastle-on-Tyne, have covered boilers, pipes, etc., with their "Tynos" non-conducting material. She was duly named the *Duffryn Manor* by Mrs. Harrison, of Penarth.

New York City. On July 31st, Messrs. Richardson, Duck and Co. launched from their yard a finely modelled steel screw steamer of the following dimensions:—length, 319 ft. 9 in.; breadth extreme, 48 ft. 3 in.; depth moulded, 25 ft.; gross tonnage, about 2985 tons. This steamer, which has been built to the order of Messrs. Chas. Hill & Sons, of Bristol, will class ✠100 A1 in Lloyd's register and has been built under their special survey. She has been built to the three-deck rule with two decks laid; an Orlop deck in forehold, a poop; bridge extending from after part of No. 2 hatch to main mast, and topgallant forecastle. Accommodation for captain, officers and engineers, etc., is provided in steel houses on bridge deck, crew and cattlemen being berthed in topgallant forecastle. A cellular double bottom throughout, also forward and after peak tanks are fitted for water ballast, and in addition a deep tank containing 500 tons of water is fitted abaft engine-room. The equipment includes eight steam winches of special design, double derricks to all hatches, masts fitted with derrick tables and crosstrees large vertical donkey boiler, steam windlass with quick-running warping ends, stockless anchors, steam steering gear, single plate rudder, and with Hamilton's special fan ventilation fore and aft. The engines by Messrs. Blair & Co., Ltd., have cylinders 26 in., $42\frac{1}{2}$ in., $69\frac{1}{2}$ in. by 45 in. stroke, steam being supplied by two extra large single-ended boilers, having a working pressure of 180 lbs. Messrs. Wailes, Dove and Co.'s bitumastic enamel was applied to the boiler-room tank, and their bitumastic covering to the tank top in boiler room. As the vessel left the ways she was christened *New York City* by Mrs. Fitt, wife of the marine superintendent of the Bristol City line.

Sussex Coast. On August 8th, Messrs. W. Harkess & Son, Ltd., launched from their yard at Middlesbrough a finely-modelled steel screw cargo steamer, which they have built to the order of Messrs. F. H. Powell & Co., of Liverpool, for their special coasting trade. The principal dimensions are: length, 180 ft., breadth 28 ft. 6 in., depth moulded 15 ft. She is fitted with exceptionally heavy deck machinery and cargo gear and her engines, by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, are intended to drive her a speed of 10 knots loaded. On leaving the ways she was christened *Sussex Coast* by Mrs. Robert Mitchell, wife of the joint managing director of the builders. The vessel has been built under the superintendence of W. Law, Junr., Esq., of Liverpool, and is the fifth vessel the builders have built for Messrs. Powell.

Turul.—On August 8th, Messrs. R. Craggs & Sons, Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer, 362 ft. 6 in. long by 49 ft. 9 in. beam by 25 ft. 10 in. depth. This vessel has been built to take the highest class under Lloyd's three-deck rule, one deck laid, having poop, bridge and forecastle. The specifications of both hull and machinery are very complete in every way to fulfil the owners' special requirements. Cellular double bottom is fitted throughout for water ballast, and in fore and after peaks, the total amount being about 1250 tons. A special feature of this vessel's construction is the arrangement of clear holds, the deck being supported upon girders and wide spaced mast pillars placed well back from hatch sides. The construction of hull and machinery has been carried out under the superintendence of Mr. Walter J. Milne. Six powerful steam winches are provided of the most approved type, steam steering gear is also supplied, and improved quick warping steam windlass is fitted forward. The arrangements for handling ship and cargo are most complete in every respect, including double derricks throughout. The machinery will be fitted by the North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne, and will have cylinders 23 in., 39 in., 66 in. by 45 in. stroke, steam being supplied by three large single-ended boilers working at 180 lbs. to the square inch. This vessel is one of the two building to the order of the Hungarian Levant Steamship Co., Ltd., of Budapest, and sister ships to the *Kossuth*, completed for the same owners last summer. On leaving the ways she was named *Turul*, by Miss Catherine Dodds.

Coleby.—On August 9th, Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*, length 365 ft., breadth 50 ft., depth 23 ft. The vessel is built to the highest class of British Corporation, to the order of Messrs. R. Ropner & Co., West Hartlepool, and is fitted with the builders' patent improved trunk deck, with clear holds and deep frames. The saloon house with accommodation for captain and officers and a house for engineers will be fitted up on trunk deck, with the crew in top-gallant forecastle, and apprentices aft. The vessel has double bottom for water ballast on the cellular principle, also in the fore and after peaks. The deadweight carrying capacity will be about 6,100 tons on her summer freeboard. The vessel will be fully equipped with an up-to-date outfit, having a quick-warping windlass, stockless anchors, steam steering gear amidships, with powerful screw gear aft. The appliances for loading and discharging expeditiously are very complete, and include extra derrick posts and double derricks, nine steam winches, steam being supplied by a horizontal multitubular donkey boiler. The engines will be of the triple expansion type, supplied by Messrs. Blair & Co., Ltd., of about 1,500 I.H.P., steam being supplied by two large main boilers, at a working pressure of 180 lbs. per square inch. The christening ceremony was gracefully performed by Mrs. Wm. Ropner, Ambleside, West Hartlepool, who gave the vessel the name of *Coleby*.

Spheroid.—On August 13th, there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields, a steel screw steamer, built to the order of Messrs. Scrutton, Sons & Co., London. The vessel has been built to Lloyd's highest class on the spar deck rule, with exceptionally high 'tween decks for the West Indian trade, the arrangements generally and the facilities for working cargo, etc., having been specially designed to meet the requirements of this particular trade and special attention has also been paid to the ventilation throughout the ship. The vessel is supplied with eleven steam winches, and is also fitted with 18 derricks worked from cross trees and tables on the masts. Cabins for passengers captain, etc., are placed in the deck-houses at the fore end of the bridge, and accommodation for officers and engineers is provided in a deck-house at the after end of bridge; there is also a house for apprentices on the poop. The engines, also constructed by Messrs. John Readhead & Sons are of the triple expansion type, having cylinders 26 in., 43 in. and 71 in. with 48 in. stroke, supplied with steam from two large steel boilers, fitted with Howden's forced draught, and working at a pressure of 180 lbs. per square inch. The vessel has been built under the superintendence of Mr. H. Barringer, of Messrs. Jacobs & Barringer, London, and under the resident supervision of Captain Norris for the hull, and Mr. Wm. Cathill for the machinery and boilers. As the vessel left the ways she was named the *Spheroid* by Miss Pattie Norris, daughter of Captain Norris.

Burnhope. On August 14th, Messrs. Wood, Skinner & Co., Ltd., launched from their shipbuilding yard at Bill Quay, Newcastle-on-Tyne, a new steel screw steamer, which has been built by them to the order of Messrs. The Burnett Steamship Co., Ltd., of Newcastle-on-Tyne. She is of the long raised quarter-deck type with bridge and topgallant forecastle. The saloon, captain's accommodation, etc., are arranged under the bridge deck amidships, the officers and engineers being berthed in sidehouses at the after end of the bridge and the crew in the top-gallant forecastle. Water ballast is provided in the cellular double bottom all fore and aft and in the fore and after peak tanks. The vessel has specially large hatches for self-trimming and will be fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo. The machinery has been constructed and will be fitted by Messrs. the North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, and is of the latest improved triple expansion type, supplied with steam by two large steel multitubular boilers. Both the ship and engines have been built to Lloyd's requirements for their 100 A1 classification and have also been superintended during construction by Mr. Norman Burnett consulting engineer, of Newcastle-on-Tyne. The launch was in every way successful and as the vessel left the ways, she was gracefully christened *Burnhope* by Mrs. Ritson, wife of Mr. W. H. Ritson, J.P., of Newcastle-on-Tyne.

Matthew Keenan & Co., Ltd., have covered the boilers, etc., on the steamship *Tabaristan*, built by Messrs. D. and W. Henderson & Co., Ltd. (of which we gave particulars in our July issue), with their patent non-conducting composition.

LAUNCHES—Scotch.

Grampian. On July 25th, there was launched from the works of Messrs. Alex. Stephen & Sons, Ltd., at Linthouse, the twin-screw steamer *Grampian*, the first of the two large passenger and cargo steamers which these eminent builders have on order for the Glasgow section of the Allan line service between Great Britain and the Dominion of Canada. The *Grampian* has, in dimensions, about reached the limits that our local docks can accommodate, and will with her sister ship, the *Hesperian*, now well advanced in construction, form an important addition to the fleet of steamers which are run under the Allan line flag from our port. The *Grampian* is 502 ft. in length, with a breadth of 60 ft. and a depth to her shelter deck of 41 ft. 6 in., and a gross register tonnage of about 10,000. She is built to the highest class of the British Corporation for the survey and register of shipping, is constructed on the cellular double bottom principle, and is specially strengthened for her North Atlantic trade. Her deadweight capacity will be about 9000 tons, and her internal cubic space will greatly exceed this figure. To facilitate the stowage of cargo, the pillaring of the holds is of the new tubular form widely spaced, and her numerous steam winches and other appliances are of the most complete design for the rapid loading and discharging of cargo. Large chambers nine in number, with a capacity of 23,000 cubic feet, are being fitted up for cold storage of cargo and ship's provisions, cooled by Messrs. J. & E. Hall's CO_2 refrigerating machinery. The passenger accommodation of the *Grampian* is in keeping in style and comfort with the advance by which the North Atlantic passenger trade is now distinguished. Her 'tween decks are lofty and her state rooms large and tastefully furnished, giving accommodation for 500 first and second-class cabin passengers and in the third-class provision is made for fourteen hundred passengers, who will be carried in four berth rooms. For each of the classes large and well appointed dining saloons music rooms, libraries lounges smoke rooms and covered in recreation spaces have been provided. The first and second class public rooms are very tastefully panelled in white enamel, in fumed oak, mahogany and other hard woods and those of the third class are finished in polished pitch pine. The ship is lighted throughout by electricity, and to ensure its unbroken maintenance the supply plant is duplicated and in addition to natural ventilation the 'tween decks and emigrants spaces are heated and ventilated on the thermotank system. There are separate

galleys amidships and at each end for passengers and crew, and they, together with the pantries, are fitted with the special outfit supplied by Messrs. Wilson, of Liverpool. The *Grampian* is a twin-screw steamer propelled by a double set of triple expansion engines, designed to maintain at sea a speed which will enable the steamer to make the passage from her last port of call, Moville, to Rimouski—the pilot station in the St. Lawrence—in less than seven days, a material advance in speed upon the existing services. Her ample boiler power is fitted with Howden's system of forced draught, and her engine room has a very complete installation of auxiliary machinery. The *Grampian* is to sail on her maiden voyage from Glasgow to Montreal on 21st September. Her sister ship, the *Hesperian*, will take her place in the service early next year in time for the Spring season's trade. Both steamers are being constructed under the personal supervision of Mr. A. M. Gordon, naval architect, Mr. David Johnston, superintendent engineer, and Captain Christie, marine superintendent, on behalf of the owners. The naming ceremony was gracefully performed by Miss May Allan, eldest daughter of Mr. Claud Allan, of Darleith.

Tuna.—On August 5th, Messrs. Ramage & Ferguson, Ltd., Leith, launched a single-screw passenger and cargo steamer built of steel to Lloyd's highest class for Messrs. Cowasjee, Dinshaw & Brothers, Aden, for service on the Aden coast. The dimensions of the vessel are 190 ft. between perpendiculars by 30 ft. breadth moulded, and 19 ft. 8 in. depth moulded to the awning deck, and the arrangements of passengers' accommodation in a large teak house on deck are specially suited for the Eastern trade. The steamer has been designed to carry a large cargo on a moderate draught of water, and the cargo discharging appliances are of the most modern description, Macfarlane's patent winches being fitted by which one man can both lift the cargo and swing the derrick over the side. A complete electric light installation is fitted throughout. The propelling machinery consists of a set of triple expansion engines with cylinders 16 in., 26 in. by 42 in. diameter by 27 in. stroke, steam being supplied from a large multitubular boiler working at a high pressure, and the engine-room is fitted up with numerous auxiliaries. The vessel has been built under the superintendence of Mr. F. J. Trewent, London. On leaving the ways the steamer was named *Tuna* by Mrs. F. Atkinson, Blackheath.

Rio Machado.—On August 10th, there was launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, a steel screw steamer of the following dimensions:—length, 151 ft.; breadth 30 ft.; depth to promenade deck, 15 ft. 10 in. The vessel is classed in Lloyd's and has been specially designed for carrying cargo and passengers on the river Amazon, and is very complete in every detail. On leaving the ways she was named *Rio Machado* and left immediately afterwards for Glasgow, where triple expansion engines of large power will be fitted on board by Messrs. Ross & Duncan.

Sarasvati.—On August 15th, Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer *Sarasvati*, which has been built to the order of The Bombay Steam Navigation Company (Edward Lawrence & Co., Liverpool), whose Glasgow agents are Messrs. T. L. Duff and Co. The vessel is about 210 ft. long between perpendiculars, and has accommodation for a limited number of passengers in deck house aft, while the 'tween decks are fitted up for carrying natives. She has a complete hydraulic crane installation, teak decks, Napier's windlass, electric light, and is designed for a speed of twelve knots, the machinery being supplied by Messrs. Rankin & Blackmore, Greenock. The vessel has been built under the superintendence of Mr. W. McA. Morison, of Glasgow. The naming ceremony was performed by Mrs. Lawrence, of Liverpool.

Lady Blanche.—On August 22nd, Messrs. Ramage & Ferguson, Ltd., launched a finely modelled steam yacht of about 400 tons yacht measurement, built to the order of Mrs. Valentine Smith, London, from the designs and under the superintendence of Messrs. Cox & King, Suffolk Street, Pall Mall, London. The yacht is constructed of steel, with an awning deck, extending nearly the whole length, under which, in a large deck house on main deck, are the dining saloon and drawing rooms, with an intercommunication passage between same; these rooms being fitted up in choice hard woods and decorated and upholstered in the most tasteful manner. The state-rooms are arranged forward and aft of the machinery space and consist of six large rooms with toilet and bath rooms *en suite*. Complete electric light and hot water heating installations are fitted, and generally the yacht embodies all the latest and most up-to-date improvements. The propelling machinery consists of a set of triple expansion engines supplied with steam from a large steel boiler working at a high pressure. On leaving the ways, the yacht was named *Lady Blanche* by Miss Winifred Ellis, of Wivenhoe.

Premier.—On August 22nd, Messrs. Wm. Simons & Co., Ltd., Renfrew, launched complete with all machinery on board and with steam up ready for work, the powerful barge loading dredger *Premier*, built by them to the order of the British Dredging Co., Ltd. The vessel, which is of the bow-wall, bucket-ladder type, is well equipped for dealing with heavy work and is capable of dredging to a depth of 50 feet below water-level. A set of compound marine engines, with steam supplied from a multitubular steel boiler of 120 lbs. w.p., drives the dredging machinery, which is designed for a nominal lifting capacity of 1,200 tons of spoil per hour. The deck machinery includes steam gear for raising and lowering the shoots, which are fitted on either side of the vessel, very powerful bow and stern winches to work with chains or wire rope, and steam capstans on either side of vessel fore and aft for bringing the barges alongside. Electric light is fitted throughout, including powerful arc lamps on deck for working at night time. Comfortable cabins for the officers and men are fitted on either side of the bucket well, also an office for the clerk of works is fitted on deck.

Vidar.—On August 22nd, there was launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, the steel screw steamer *Vidar*, the second of two sister vessels built this year to the order of Wicanders Rederi Aktiebolag, Stockholm. The dimensions of the vessel are: length between perpendiculars, 285 ft.; breadth, 42 ft.; depth, 22 ft.; and the deadweight carrying capacity about 3,500 tons on a light draught. Triple expansion engines will be supplied by Messrs. David Rowan and Co. During construction the owners have been represented by Captain E. Forsberg.

Cochran (Annan) Donkey Boilers with patent seamless furnace have been supplied to the S.S.s. "Cacero" and "Karatta."

LAUNCH—Irish.

Rio de Janeiro.—On August 16th, Messrs. Workman, Clark & Co., Ltd., launched from their South Yard, at Belfast, a handsomely modelled steamer, the fourth of nine vessels now being built and engined by them for the Lloyd Brazileiro of Rio de Janeiro. The interesting function was successfully carried out in the presence of a party representative of the owners and builders, and the ceremony of christening and naming the vessel *Rio de Janeiro* was performed in a graceful manner by Miss Edith Haynes, the daughter of Mr. H. Haynes, secretary to the Lloyd Brazileiro London Agency, who represented on the occasion Mrs. Muller, the wife of Dr. Lauro Muller, of Rio de Janeiro. The *Rio de Janeiro* is a sister ship to the *Sao Paulo*, which was launched a few weeks ago, and is 356 feet in length, with a gross tonnage of over 3,500. She is being built under Lloyd's special survey for the highest class in their registry and complies with the Board of Trade requirements for a foreign-going passenger steamer. The new steamer is intended for passenger and cargo trade between the principal ports of the American continent, and the special requirements of this trade have received full consideration at the hands of the designers. The private and public rooms throughout the vessel are replete with all the latest ideas for ensuring the comfort of travellers. Accommodation is provided for over fifty first-class passengers, twenty second-class and one hundred and fifty third-class. The first-class state-rooms, placed in a large deck-house on the bridge deck are all roomy and well-lighted apartments, arranged to accommodate one, two and three persons. A large entrance hall fitted up as a comfortable lounge, with a luxuriously furnished music-room adjoining has been arranged at the forward end of the bridge deck house. At the after

end of the same house a wide staircase leads up to the handsomely appointed smoke-room on the boat deck, at the after end of which an alcove has been arranged, in which passengers can enjoy a lounge in the open air. Extensive space for amusements and comfortable promenading is provided on the boat deck, with lounge seats in the sheltered corners. The dining saloon is a large and well-lighted apartment on the upper deck, extending the full width of the vessel, and is approached from the entrance hall by a handsome wide staircase. The second-class passengers' rooms have been arranged in a house on the poop deck with the dining saloon at the forward end of the house, while the third-class passengers are accommodated in the poop space, which is fitted up with iron beds. Special attention has been given to the ventilation of all the passenger spaces by natural and artificial means, so as to ensure the comfort of the passengers in the hottest climates, and together with the sanitary arrangements throughout, will be found to be of the most satisfactory character. The cargo holds, four in number, are each efficiently equipped with a couple of steam cranes, capable of expeditiously handling a general cargo. One of the 'tween deck spaces has been fitted up and suitably insulated for the carriage of perishable cargo, and similarly-prepared chambers are provided for the stowage of provisions, vegetables, etc., for consumption during the voyage ; for the preservation of this cargo and stores an efficient installation of refrigerating machinery has been provided. The propelling machinery of this vessel consists of two sets of triple expansion engines with three steel cylindrical multitubular boilers working under Howden's system of forced draught. The designing and construction of the vessel and machinery have been carried out under the direction of Dr. Rosauro de Almeida, Commander Engineer of the Brazilian Navy and Technical Director in Chief for the Lloyd Brazileiro.

TRIAL TRIPS.

Ambriz.—On July 24th, the fine steel screw passenger and cargo steamer *Ambriz* (of which we gave particulars in our August issue, page 33), built by Sir Raylton Dixon and Co., Ltd., of Cleveland Dockyard, Middlesbrough, to the order of Messrs. Empreza Nacional de Navegacao, of Lisbon, proceeded to sea for her official trials, which passed off most successfully, and the vessel proceeded to Lisbon under the command of Captain Fernando de Costa Lisboa. The vessel and her engines have been constructed under the superintendence of Mr. T. C. Laws, of Liverpool, the owners' superintendent.

Hartington.—On July 27th, the handsome steel screw steamer *Hartington* (of which we gave particulars in our August issue, page 33), built by Messrs. Wm. Gray & Co., Ltd., West Hartlepool, for Messrs. J. & C. Harrison, Ltd., of London, was taken to sea for her trial trip. The engines were run at full speed to the Tyne, at a point to point speed of twelve knots, the performance of the ship and machinery being highly satisfactory. Mr. E. J. Caiger, under whose supervision the ship and machinery have been constructed, represented the owners, Capt. Murrell the shipbuilders, and Mr. Maurice Gibb the engine builders. On arrival of the vessel at the Tyne Mr. Charles Harrison, of the firm of Messrs. J. C. Harrison, came on board accompanied by Mrs. and Miss Harrison, and inspected the vessel.

Lowenburg.—On July 27th, the s.s. *Lowenburg* (of which we gave particulars in our July issue, page 459), built by Swan, Hunter & Wigham Richardson, Ltd., for the Deutsche Dampfschiffahrts Gesellschaft "Hansa," of Bremen, for their River Plate trade, left the river after a very successful trial trip. The vessel attained a speed of 11½ knots and the owners were represented on the trial trip by Mr. Wultt, of Bremen, their superintendent ; immediately on the conclusion thereof the vessel sailed for Bremen under the command of Capt. Soeken.

Muirfield.—On August 1st, the new screw steamer *Muirfield* (of which we gave particulars in our August issue, page 33), built to the order of the Doughty Shipping Co., Ltd., West Hartlepool, by Messrs. John Readhead & Sons, West Docks, South Shields, was taken to sea on her official trial trip, which was in every way satisfactory to all concerned. The vessel returned to Tyne Dock to load for Porto Vecchia under the command of Capt. P. Boyle. The vessel and engines have been built under the supervision of Mr. H. Brandon, superintendent for the company.

Kronprinz Olav.—On August 3rd, the steamer *Kronprinz Olav* (of which we gave particulars in our July issue, page 459), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesbrough, to the order of Consul Johan Bryde, of Sandefjord, Norway, proceeded to sea for her official trials. On completion of the trial, which passed off most successfully, the vessel proceeded to the Tyne to load under the command of Captain R. A. Nillse under whose superintendence the hull and engine have been constructed.

Ingleby.—On August 5th, the steamship *Ingleby* (of which we gave particulars in our August issue, page 34), built by Messrs. Ropner & Son, of Stockton-on-Tees, made her official trial trip in the Tees Bay. The steamer has been built to the order of Messrs. R. Ropner & Co., of West Hartlepool. After a very satisfactory trial trip, during which a speed of over eleven knots was attained, the steamer proceeded to West Hartlepool to load. The owners were represented by their superintendent, Mr. White, and the builders by Mr. C. K. Jack.

Miranda.—On August 8th, the twin-screw steamer *Miranda* ran her trials on the Forth. She has been built by Messrs. Mackay Brothers, Alloa, and engined by Messrs. Aitchison, Blair & Co., Clydebank, for the Lloyd Brazileiro. Under loaded conditions a full power speed of 11¾ knots was obtained, and thereafter the vessel steamed for several hours at her guaranteed speed of ten knots. The trial was superintended by Dr. Rasauro de Almeida on behalf of the owners. The vessel is supplied with a Cochran (Annan) donkey boiler with patent seamless furnace.

Tord.—On August 8th, the steel screw steamer *Tord*, built by Messrs. W. Harkess & Son, Ltd., of Middlesbrough-on-Tees, for Messrs. G. & L. Beijer, of Stockholm, was taken to sea for her trial trip. She has been built to Lloyd's register highest class. Length, 246 ft ; breadth, 38 ft. ; depth moulded, 18 ft. Her engines are by Messrs. The North-Eastern Marine Engineering Co., Ltd. of Sunderland having cylinders 18 in., 30 in., 40 in. by 33 in., two boilers 12 ft. 9 in. by 10 ft. 6 in. Electric light fitted by Messrs. Campbell and Isherwood, of Liverpool. The trials passed most successfully. She is under the command of Captain Sandberg who, together with Messrs. Thompson & Eyres, of Sunderland, have superintended the building of both ship and engines.

Antinoe.—On August 9th, the steel screw steamer *Antinoe* (of which we gave particulars in our August issue, page 33), built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of the Egypt & Levant Steamship Co., Ltd., of London (Messrs. Alfred Laming & Co. London), was taken to sea for her trial trip, which proved highly satisfactory. On the run from Hartlepool Heugh to Souter Point, a speed of 12 knots was maintained. The owners were represented by Mr. W. H. Robson of Cardiff, the superintendent engineer, who expressed himself as being highly pleased with the ship and engines. After the trial trip the vessel proceeded to the Tyne under the command of Captain Perryman.

Blackwood.—On August 9th, the screw steamer *Blackwood* (of which we gave particulars in our August issue, page 34), built by the Blyth Shipbuilding Co. Ltd., for Messrs. The Tyneside Line, Ltd. (Messrs. J. Ridley, Son & Tully, managers), of Newcastle-on-Tyne, was taken to sea for trial. Triple expansion engines of ample power have been fitted by Messrs. North-Eastern Marine Engineering Co., Ltd., of Sunderland ; cylinders 19 in., 31 in. and 51 in. by 36 in. stroke, with one large boiler working at 180 lbs. pressure. The *Blackwood* was run several times over the measured mile and good results were obtained, the representatives of owners builders and engineers on board being highly satisfied with the speed and also the smooth working of machinery.

Queen of the Lake.—On August 13th, the twin screw steamer *Queen of the Lake*, built by the Ailsa Shipbuilding Co., Ltd., for the Loch Tay Steamboat Co., Ltd., and recently launched at Kenmore, went on her official trials with representatives of shipbuilders and owners on board. These trials were of the most exhaustive and comprehensive nature, including progressive runs at many various speeds, and the results obtained were most satisfactory. After the usual trials the vessel ran the full length of the loch from Kenmore Pier to Killin Pier, the engines running with great smoothness and easily maintaining full speed, doing the distance at the rate of 12 knots per hour. The steamer has accommodation for over 500 passengers, with fine deck-room and commodious handsomely furnished saloons, and she will doubtless be greatly appreciated by the travelling public. The Company's flag was hoisted after the trials, and she is now being outfitted and prepared to take up the service between Killin and Kenmore.

Celtic King.—On August 17th, the steamer *Celtic King* (of which we gave particulars in our August issue, page 35), recently completed by Messrs. Archd. McMillan & Son, Ltd., Dumbarton, for Messrs. R. Hughes-Jones & Co., Liverpool, went down the Firth on her trial trip, which was in every way satisfactory, a speed of 12½ knots being obtained on the measured mile.

Wychwood.—On August 20th, Messrs. Osbourne, Graham and Co., Hylton, sent to sea for her official loaded trial trip, the steel screw steamer *Wychwood* (of which we gave particulars in our August issue, page 35), the fifth vessel they have specially constructed to the order of Messrs. Wm. France, Fenwick & Co., Ltd., of Sunderland and London. The trial was in every way satisfactory, a mean speed of 10½ knots being easily attained. After the trial the vessel proceeded on her first voyage.

Steam Launch Tug. Mr. Edward Hayes, of Stony Stratford, has lately run the speed trial of another of their 51 ft. steam launch tugs, in this case for the Brazilian Navy. Her width is 11 feet, draught about 4 feet. She exceeded her specified speed by 1¼ miles, averaging 12¼ with and against the tide. She is fitted with one of their standard 8 in. and 16 in. by 10 in. C.S.C. sets of machinery and marine return tube boiler; built to Lloyd's survey for 120 lbs. W.P. She has roomy cabins fore and aft and polished teak deck fittings. She showed herself to be very easily handled, quick on the rudder and a very good rough water boat. They are completing another for the Chilian Customs.

Wailes, Dove & Co.'s bitumastic covering was applied to the tank top in engine and boiler spaces and their bitumastic enamel to the lower and 'tween deck bunkers of the steamship *Baron Herries*, and their bitumastic covering was applied to the tank top in boiler space and their bitumastic enamel to the bunkers and tanks under engines and boilers of the steamship *Daldorch*.

BOARD OF TRADE EXAMINATIONS.

Extra First Class — July 27th, 1907.

Baker, Alfred H .. .	Ex 1C London
Binder, James F.	Ex 1C N Shields
Blair, George C	Ex 1C London
Cass, John F.	Ex 1C N Shields
Edman, William C	Ex 1C London
Fitzgerald, Percy	Ex 1C Liverpool
Haxton, Robert ..	Ex 1C London
Morgan, Reginald J ..	Ex 1C N Shields
Nicholson, Thomas .	Ex 1C N Shields
Reid, William .. .	Ex 1C N Shields
Riggs, Arthur L	Ex 1C London
Temple, Sydney J	Ex 1C London
Turnbull, Leopold A ..	Ex 1C Liverpool
Wallace, Robert D	Ex 1C N Shields

August 3rd, 1907

Jeans, Alfred	Ex 1C Sunderl'd

NOTE.—1C denotes First Class, 2C Second Class.

July 27th

Blaxland, R. S.	2C	Sunderl'd
Bowden, Wm. ..	2C	London
Boyd, John S ..	1C	Liverpool
Campbell, John	1C	Aberdeen
Chisholm, Wm J. A.	2C	Sunderl'd
Cundall, N. S..	2C	Hull
Davidson, D ..	1C	Aberdeen
Davies, Thos...	2C	Liverpool
Donaldson, John	1C	Aberdeen
Duke, William	2C	Liverpool
Evans, Herbert	2C	N Shields
Hallatt, Alf. L.	2C	Hull
Hart, E. S.	2C	London
Johnston, James	1C	Greenock
Kaberry, R. W	1C	Liverpool
Lane, Wm. A	2C	Greenock
Langan, Bernard	2C	Liverpool
Lee, Charles P.	1C	Bristol
Liddle, Robt. A.	1C	Sunderl'd
Livingstone, Hugh A.	2C	Liverpool
Lockhead, John	1C	London
Logan, Thomas	2C	London
Lyne, W T. L.	2C	Liverpool
Newmarch, W.	2C	N Shields
Paulson, E. U.	2C	N Shields
Pearse, H P. ..	2C	Liverpool
Pritchard, C. H.	2C	Bristol
Redpath, Alfred	2C	Hull
Reynolds, J. C.	2C	Liverpool
Robertson, Jas.	1C	Aberdeen
Robertson, Jas	2C	Greenock
Ross, George ..	2C	Aberdeen
Sainsbury, H. A	2C	Hull
Scrutton, A. D.	2C	London
Simpson, W. M	1C	Bristol
Sinclair, John ..	2C	Aberdeen
Stalvies, J H.	2C	Bristol
Stewart, James	2C	Aberdeen
Stuart, Charles	2C	Liverpool
Tatham, Alan..	2C	Liverpool
Thomson, Alex.	2C	N Shields
Thornburn, J. D	1C	N. Shields
Tidman, A R	2C	Hull
Tracey, Alfred	2C	N. Shields
Wayman, Wm.	1C	Sunderl'd
Wilson, Albert	2C	Sunderl'd
Wilson, W. J	1C	Liverpool
Young, David A.	2C	Bristol
Youngson, Geo	1C	Aberdeen

August 3rd.

Aguirre, Aferino	1C	Liverpool
Barltrop, Claude	2C	London
Barrie, John K	1C	Leith
Browne, Bert	2C	South'ton
Bussy, Jas H	1C	London
Douglas, H A	1C	Belfast
Edwards, R G.	1C	Liverpool
Evans, Stanley	2C	Cardiff
Falconer, Jas...	2C	N Shields
Ford, John G..	2C	Glasgow
Griffiths, B P	1C	Liverpool
Hanna, Robert	1C	London
Herbert, Thos	2C	Cardiff
Kerr, Malcolm	2C	Glasgow
Knapp, O R ..	2C	Cardiff
Kreibich, Franz	2C	Cardiff
Laing, James ..	1C	N Shields
Maney, Wm C	1C	Leith
Marsh, H G ..	2C	Liverpool
Marshall, David	2C	Leith
Matheson, H C	2C	London
Meldrum, Geo.	1C	Leith
Musgrove, Wm	1C	London
Niven, William	1C	Glasgow
O'Brien, C S	1C	London
Potts, John N	1C	N. Shields
Pratt, Robert A.	1C	N Shields
Richardson, Robt R.	2C	N Shields
Riches, Wm. C.	2C	London
Roberts, D G.	1C	Liverpool
Roberts, T. H.	2C	Liverpool
Scott, John T.	1C	N Shields
Seaman, Wm ..	2C	Cardiff
Sinclair, Frank	2C	London
Slimming, Henry N A.	1C	Liverpool
Storm, James ..	2C	London
Thomas O. T.	1C	Liverpool
Thomas, J. S...	2C	Cardiff
Thomson, E. A	1C	London
Thomson, Alex.	2C	Leith
Tweedie, Wm. M'K	1C	Glasgow
Vincent, John C.	2C	London
Wallbridge, T.	1C	Leith
Watson, E. A.	2C	Leith
Watson, Thomas	1C	Leith
Wellard, Claud	2C	London
Wilson, Henry	1C	Liverpool

August 10th.

Alexander, W L	2C	Liverpool
Bain, Edward..	2C	N. Shields
Brodie, Wm. J	2C	Liverpool
Burge, Wm. H	1C	London
Campbell, J W	1C	Liverpool
Cannell, Thos.	1C	Liverpool
Clarke, Edward	1C	N. Shields
Evans, Robt. C.	1C	Liverpool
Harvey, Fredk.	2C	N Shields
Haslam, Herbt	2C	Liverpool
Hobson, Robert	2C	N Shields
Holdsworth, A.	2C	London
Hughes, John..	2C	Liverpool
Jones, Stanley	2C	Liverpool
Knott, John H	1C	Liverpool
Lambert, W. H	2C	London
Latham, R. J	2C	Liverpool
Mallet, T W ..	1C	London
Metcalf, John G	1C	N. Shields
Murray, F R ..	1C	N Shields
Nelson, James	1C	N Shields
O'Gallagher, T	1C	London
Pole, Oscar H	2C	London
Rowe, Fred. E	1C	N Shields
Sparks, Harold	1C	Liverpool
Taphouse, W C	1C	London
Thomson, J. M D	1C	N. Shields
Tim, Fredk W.	2C	London
Wengi, L. B. ..	1C	London

August 17th

Bates, Walter L.	2C	Hull
Blackwood, J. N	2C	Greenock
Brown, W. H	1C	Hull
Cuttle, H H .	2C	Hull
Edmond, J. T	1C	N. Shields
Evans, Samuel	1C	Liverpool
Fernie, John ..	1C	Dundee
Finch, Thos N	2C	N Shields
Gidley, A. H ..	2C	Hull
Halliday, M. C	1C	Greenock
Hilliard, Alex .	2C	Greenock
Hodgson, G W	1C	N Shields
Lawson, C A	2C	London
Lochhead, Chas H B	1C	Greenock
Mercer, E. J. ..	1C	Liverpool
Milne, Alex. W.	1C	Dundee
Naysmith, W. G	2C	Greenock
Nuttall, Reginald	2C	N Shields
Oldfield, J E	2C	Liverpool
Paterson, J M.	2C	Greenock
Thompson, A	2C	Liverpool
Thomson, T A. S	2C	N Shields
Vickers, Harold	1C	Liverpool
Wylie, James ..	1C	Dublin

June 22nd.

Speech, C G should read Speechly, C C

The Marine Engineer
And Naval Architect.
LONDON, OCTOBER 1, 1907.

THE Institute of Marine Engineers paid an official visit to the Engineering Exhibition at Olympia on September 28th, when two papers were read in the lecture-hall of the Exhibition. These papers are of considerable interest and value—the one dealing with a new method, which has now gone beyond the experimental stage, of repairing boilers by means of welding and fusing pieces of iron and steel to cracks and wasted portions of plates; the other paper treating of ventilation and sanitation, two branches of a subject which is more often considered after than before the event of building, involving many complaints, troubles and expense which forethought might have avoided. These papers are well illustrated, and as they will be appreciated by all engineers, we have pleasure in placing both papers before our readers, also reproducing the illustrations. A prize is offered for the best essay or essays written by graduates (apprentice engineers) of the Institute on "A Visit to the Exhibition." This is an excellent opportunity for the young men to take advantage of; it ought to serve as an encouragement for them to take notes and commit their ideas to paper. During the summer the Institute of Marine Engineers has been paying visits to works on occasional Saturday afternoons. This visit to the Exhibition inaugurates the session for papers and discussions, and on Monday evening, October 7th, at their own premises, the President is expected to deliver the opening address, and it is with pleasure we give in this issue his portrait.

THE "LUSITANIA."

NEVER probably in the history of steam navigation has so much interest been excited by the progress of a voyage as that which has been aroused by the successful maiden trip of the *Lusitania*. There are more reasons than one why this is so. The multitude is always attracted by extremes, and therefore the *Lusitania*, which in every dimension exceeds everything that floats—save, indeed, her own Tyne-built sister the *Mauretania*—was bound to attract great attention. But in her case size is perhaps the least of her real claims to notice; she is only so big because it would be impossible in a smaller vessel to combine all the other qualities in which she excels. For all classes of passengers, as our description in last month's issue proved, she offers the extreme of comfort and luxury. She is a floating hotel, offering accommodation surpassing anything which any but, perhaps, one or two joint-stock palaces in wealthy cities can pretend to give. Of the hundreds of passengers who made a successful trip in her on this memorable maiden voyage how many could truthfully say that they had ever had so luxurious a time in their lives? Probably it would be found that passengers of every class, even the cheapest, were enjoying unaccustomed luxuries and comforts. The size, the power, the luxury of the *Lusitania* no doubt appealed to the multitudes who welcomed her on her arrival at New York, and who followed with almost feverish excitement the publication of the Marconigrams which told how she was reeling off the miles of her long and arduous course. But to many of our readers, and to many of the two hundred thousand persons who are computed to have witnessed her departure from the Mersey, there is a deeper interest in her performance, a more sincere feeling of satisfaction at the conviction that, on the promise of her maiden trip, she will assuredly, all being well, when the proper time comes, surpass the performance of any vessel which has ever accomplished the Atlantic voyage. For the *Lusitania* is of British design and construction; she is owned and manned by our fellow-countrymen. Though little has been openly said on the matter, there has been much regret in many people's minds that for so long the palm of speed in the Atlantic, so long a British possession, has been enjoyed by vessels flying a foreign flag. But all that will be changed. The *Lusitania* has beaten the maiden record; she has surpassed that of the latest German vessel by over a knot, and more she was not asked to do. It would have been foolish indeed to have pressed her before her engines were settled, before the human element in the ship had got used to the vast and delicate machine from which they are eventually to extract the last fraction of a knot in speed. We may be sure that when she gets settled down and opportunity offers the *Lusitania* will more than fulfil expectations, and will prove as profitable to her owners as she is creditable to those who produced her.

Other companies have other great vessels on paper. Some are to be greater even than the *Lusitania*. But when we regard the vast capital expenditure, and the even heavier relative expense of running which speed at 25 knots and upwards involves, we may well wonder if just at present any great company will feel justified in challenging Cunard's for a new record. Herr Ballin himself, by his remarks in a recent speech, has rather seemed to indicate that he himself believes that greater speed than that now attained is not under present conditions likely to be commercially convenient.

Scottish Industries.—The revival of a decaying industry is a matter for congratulation, and the efforts made by those who can and will aid in bringing about such a desirable end, as the employment of the people of the country to produce articles useful and ornamental, deserve the help and support of all who have the national weal at heart. Miss Farquharson, of Invercauld, is raising a fund for the purpose of reviving and re-establishing certain Scottish industries, and a concert is to be given in the Town Hall, Stratford, to assist the fund. The concert is on Friday, October 4th, at 7.30 p.m.

JAS. KNOTT, Esq., J.P.

President of the Institute of Marine Engineers.

IT is always of interest to see the portrait of one who has risen to a position which gives power and authority, and when in addition to such, the position carries with it the employment and control of a large number of men, the interest is considerably enhanced; we then have eminence, personal influence and responsibility, three forces which unitedly act and react upon our national life and serve as gauges by which other nationalities test the framework of our being. The Managing Director of the Prince Line of steamers, who was elected by the members of The Institute of Marine Engineers as their President for the present session, is one who has risen to eminence and to control the destinies of many of the various undertakings in which he is interested as a steamship owner and colliery proprietor, with the several offshoots from these, which has become more and more a feature of commercial life during recent years. Besides occupying his attention with the extensive operations necessary to carry on successfully the business connected with a large number of steamers, Mr. Knott, who was born at Howdon on Tyne in 1855, devotes time to the county of which he is a Justice of the Peace, and wherein he has his residence. He is also a member of local associations which have for their objects the upholding of the dignity of the empire and the ameliorating of the conditions of those to whom misfortune has been unkind, or upon whom the younger daughters of fortune have not smiled.

On leaving his scholastic training, earlier than is generally looked upon as the finishing age for such, Mr. Knott entered the office of a ship-broker at Newcastle-on-Tyne, when 14½ years of age. By the exercise of steady application to work and study in connection with the various details of business, he acquired a good knowledge of shipping, stored and ready for the day when the auspices might be favourable to strike out on his own account. That day arrived when, at the age of twenty, he commenced business, and acting as broker for the Whitby and Robin Hood's Bay shipowners, he came into contact with a hardy, industrious and economical type of men, the captains being part owners of the vessels under their command. The experience proved invaluable, and two years later advantage was taken of an opportunity when a brig named the *Pearl*, of Scarborough, was for sale. She was bought by the young shipowner for £198, and proved to be of genuine value—her name and career being found in keeping with one another. This small venture formed the nucleus around which were soon clustered other and larger ships, well appointed, and bought at a time when sails were rapidly giving place to machinery as the motive power, when indeed the motto on the crest of the Institute of Marine

Photo by Jas. Bacon & Sons, Newcastle-on-Tyne

James Knott, Esq., President of the Institute of Marine Engineers.

Engineers "nec remis, nec velis," was fast becoming an accomplished fact in respect to the navigation of the ocean. In these circumstances the purchase value of sailing vessels was depreciated, but under the management of Mr. Knott the actual value became enhanced, and in the course of a few years nearly forty vessels, many of them of fine and superior class, were obtained and placed in trades which proved so remunerative that success crowned the increased and increasing ventures. In 1881 a change was made from sail to steam, when the *Saxon Prince* was built. This steamer was launched on a Friday, started away on a Good Friday, finished a year's work on a Friday, and upset the old superstition regarding this day of the week, by recording a success and yielding a return of 40 per cent. Desiring to qualify for the Bar, Mr. Knott, about four years after the *Saxon Prince* was built, set to work to study and after passing all the necessary examinations was called in 1889 and after practising for a time found that the claims of shipping and commerce were increasing to such an extent that he decided to devote his attention more exclusively to his first love. Other Princes followed the Saxon year by year, almost exclusively of the tramp species, until 1895, when the policy of placing the steamers on regular lines was inaugurated, and now there are forty-three vessels in the fleet engaged chiefly in regular services to the River Plate, Brazil, South Africa, China, Japan and the Mediterranean, also from the Mediterranean to New York in the passenger and emigration services. To indicate the contrast between the sizes of steamers of twenty-six years ago and now, and the great advance made during that time, the pioneer *Saxon Prince* carried 1250 tons and was fitted with compound engines, while the most recent additions to the Prince Line carry 10,000 tons, and are fitted with quadruple expansion engines. In closing this sketch we express the hope that the President of the Institute of Marine Engineers may continue to enjoy the gifts of fortune and success in all his undertakings, and may the Institute itself prosper abundantly during Mr. Knott's year of office.

NEW METHODS OF EFFECTING BOILER REPAIRS.*

By Mr. Harry Ruck-Keene (Member).

The repairing of boilers is a subject which I think must always be of interest to marine engineers, and I propose in this paper to describe two processes of effecting repairs, by welding in place, which have so far given satisfactory results, and at the same time have effected repairs at probably less cost and in many cases in less time than by the ordinary methods of welding. These processes are the Oxy-Acetylene and Electric systems of welding, whereby cracks in plates may be welded up in place, patches may be fitted and welded in place without forming new seams, as would be necessary if they were riveted, and wasted plates and landing edges may be built up to their required thicknesses. Now the ordinary form of welding can certainly not be called a new process, for though I have been unable to find who was the first discoverer of the art of welding, yet on referring to the iv. chapter of Genesis I find that Tubal Cain (who lived about 3950 years B.C.) is there described as "an instructor of every artificer in brass and iron," and so we may fairly conclude that the ordinary form of welding was known in those days. And by the ordinary form of welding in wrought iron or steel I mean that which consists of the parts to be united being heated to a suitable temperature at which they become plastic, but not actually fused, and are then united by hammering, squeezing or rolling. Although the metal itself does not become fused at this temperature, yet it becomes rapidly oxidized, but the oxide formed is liquid at this temperature and in properly made welds it is entirely squeezed out from between the surfaces to be welded. To render the oxide still more liquid and, therefore, more easily expelled from the weld, a flux of white sand (silica) is sometimes used; this forms with the oxide a silicate of iron which has a lower melting point than oxide of iron, and although when a flux is used the iron or steel is probably less adhesive than it is at the temperature at which the oxide melts, yet the importance of using every means of getting rid of the scale between the surfaces to be welded justifies the use of a flux in most cases. But to come down from the days of Tubal Cain to more modern times, it was the practice of several well-known firms when making iron boilers to weld the longitudinal seams of the shell plates

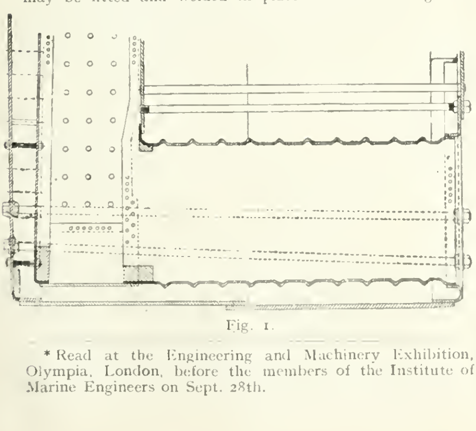


Fig. 1.

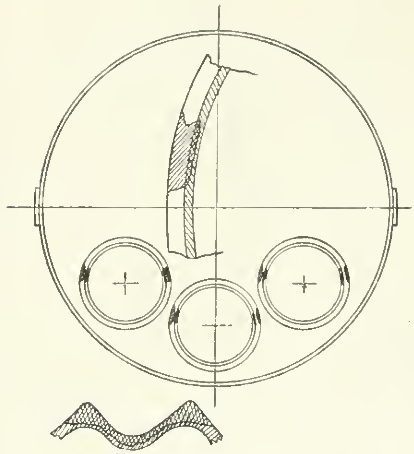


Fig. 2.

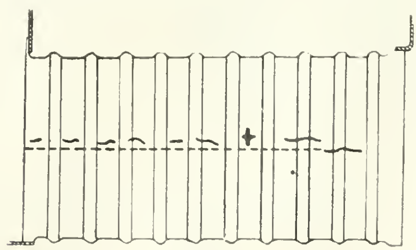


Fig. 3.

* Read at the Engineering and Machinery Exhibition, Olympia, London, before the members of the Institute of Marine Engineers on Sept. 28th.

of boilers instead of riveting them, and in 1874 some exhaustive tests then made proved the efficiency of these welded seams to be about 70 per cent. of the solid plate. And I have only heard of one case in which the weld gave way, and that was in 1889, when a boiler, eight years old, was subjected to hydraulic test, after undergoing repairs, and the longitudinal seam cracked through the weld for a length of about six inches. When steel took the place of iron in the manufacture of boilers this practice of welding longitudinal

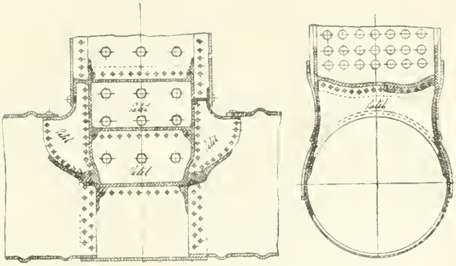


Fig. 4.

seams was discontinued. But many firms still continue to weld the furnaces to the tube plates in steel boilers; and it is the universal practice nowadays to weld the longitudinal seams of furnaces, no matter whether they be of the plain, corrugated or ribbed type. So that it will be seen that welding, though decried by many engineers, is still extensively used in the manufacture of boilers. In the Oxy-Acetylene and Electric processes of welding, though the surfaces of the metal to be welded are heated up to practically the same temperature as in the ordinary methods of welding, yet the subsequent hammering, squeezing or rolling is dispensed with, except in that process of electric welding which I propose to describe where a certain amount of hammering is still used in making the weld. For the purpose of repairing boilers by the Oxy-Acetylene process the necessary apparatus practically consists of a steel cylinder containing oxygen gas and another containing dissolved acetylene, both under pressure, a special blow-pipe, flexible tubes for transmitting the gases from the cylinders to the blow-pipe,

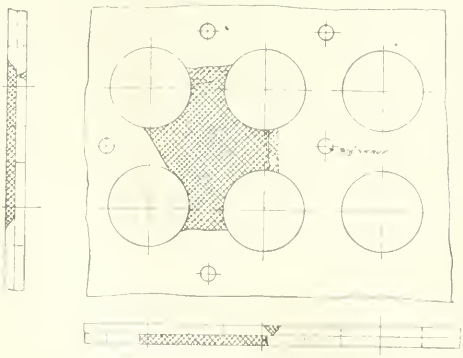
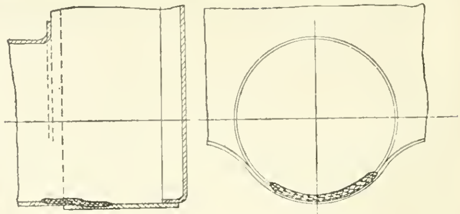


Fig. 5.

and small bars or rods of iron or mild steel about three 16ths in. diameter, which are fused and attach themselves to the parts to be united. The oxygen and acetylene gases in these cylinders are led to the blow-pipe by means of the before-mentioned pipes and there ignited at the nozzle, the resultant flame giving out an intense heat. Where plates are wasted away by corrosion or otherwise, the wasted parts are first thoroughly cleaned to remove any dirt or grease, and are then heated to a welding heat by means of the flame



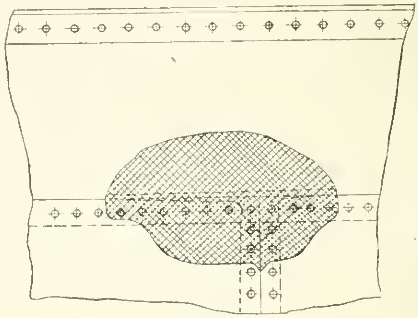


Fig. 6.

from the blow-pipe; the iron or steel bar is in the meantime held in this flame until a small portion at the end of the bar is melted off and attached to the part to be repaired, and this process is continued until by the addition of drop after drop sufficient metal has been added to bring the plate up to its required thickness. When a crack in a plate has to be welded up, the metal on either side of the crack is cut away to form a V-shaped groove, and thus enable the flame to penetrate to the bottom of the crack and heat the surrounding metal to the required temperature, metal being at the same time added from the small bar to fill up the groove, in the same way as the wasted plate was built up. In a similar manner, by chamfering away the edges, two plates can be welded together. Naturally in all these cases great care must be taken to see that each and every piece of metal added becomes firmly attached before adding more metal to it. This process has been very satisfactorily employed in this country for many purposes, and more especially for welding flanges and branches on iron and steel pipes (which have to withstand high pressure), but so far it has been little used for effecting boiler repairs. In Marseilles and Genoa

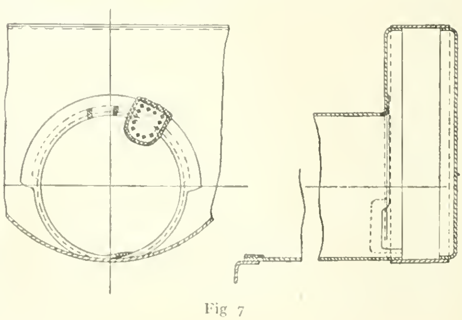


Fig 7

quite a considerable number of boiler repairs have, however, been carried out in the last few years by this process with satisfactory results. Among other repairs I may mention those carried out to two marine boilers, where the bottom plating of the combustion chambers and the lower part of the combustion chamber back plating, and also parts of the furnaces (nineteen 32nds in. thick) were considerably wasted by corrosion, the defective parts were cut out, patches made to suit, and instead of riveting them on, they were welded in place by this process, thus avoiding the making of additional riveted seams in the furnaces and combustion chambers, which often give so much trouble in boilers. The landing

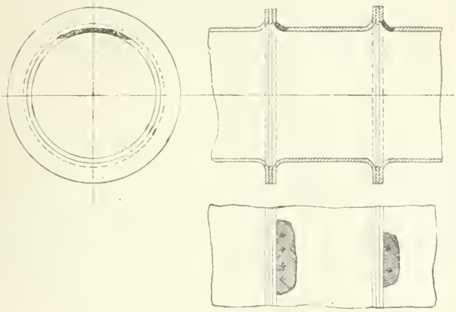


Fig. 8.

edges of the lower part of the back end plates of these boilers were also considerably wasted, and these were made good and built up to their original thickness in the manner I have already described. These repairs were carried out under the supervision of my colleague (Mr. Jones) at Marseilles in June, 1906, and after twelve months' work they were again examined in July last and found to be quite satisfactory and showing no signs of leakage. In another case eighteen furnaces of the main boilers of another vessel were so badly wasted by corrosion on the water side near the line of fire-bars, that in the ordinary way these furnaces would have had to be renewed, but by this process the wasted parts of these furnaces were built up to their required thicknesses by welding on sufficient metal piece by piece, thus saving the time and expense of renewing the furnaces. In another

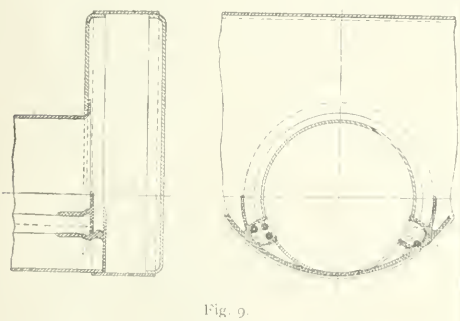
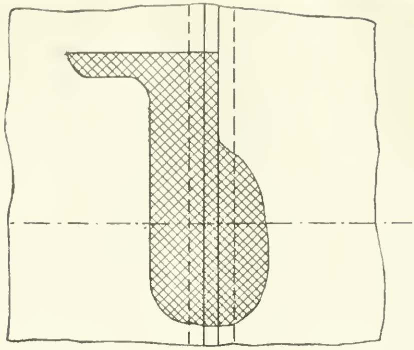


Fig. 9.

case the furnaces of some other boilers were badly wasted and cracked, and these were satisfactorily welded up by the same process; there being in all about 100 cracks in the two furnaces and the repairs taking about three weeks. Figs. 1 to 3, I think, explain these repairs better than I can describe them on paper. I could cite many more cases, but I think those I have mentioned will give some idea of what can and has been done in repairing boilers by this process. After the welding operation it is usually considered better



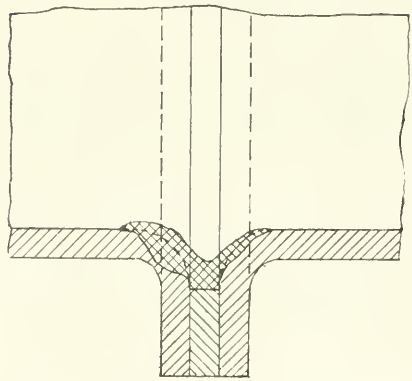


Fig. 10

to heat the surrounding plate by means of the blow-pipe flame to counteract, as far as possible, the strains that might be set up by the intense local heat. Naturally if it were possible it would be better to properly anneal the plate dealt with. This process has also been very usefully employed in the cutting out of defective and damaged plates, the flame from the blow-pipe melting and thus cutting a groove about three 16ths in. wide, in much the same way

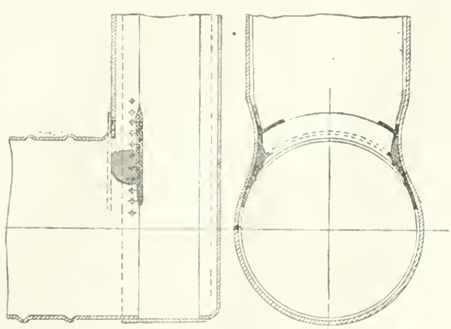


Fig. 11

as would be done by a band saw, the separation being quite as cleanly and accurately done and in much less time than by the ordinary methods of hand cutting. The following are results of tests, made in June last, from samples taken from a plate welded by the Oxy-Acetylene process, and are the same as those I gave in a paper read at the Engineering Conference of the Institution of Civil Engineers.

Oxy-Acetylene Welding.

	Breadth	Thick-ness.	Area.	Tons, Total.	Tons per sq. in.	Extension in 4 ins. per cent.	
	in.	in.	in.				
Not annealed .	1·5	·62	·93	22·85	24·5	30	Solid Plate.
Annealed ..	1·5	·62	·93	22·35	24·0	36	
						Extension in 8 ins. per cent.	
Not annealed .	1·5	·62	·93	22·9	24·6	28	Broke away from the weld.
Annealed ..	1·5	·63	·945	22·1	23·3	29	

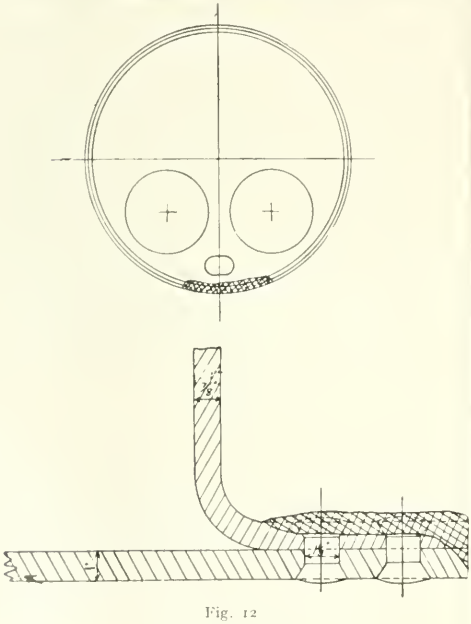


Fig. 12

Cold Bends.

Not annealed.... 180°
Annealed ...... 180°

They show not only the efficiency of the weld, but also that the ductility of the surrounding metal in way of the weld has not been distressed by the intense local heat. It will be noticed that the tensile strength of the welded plate is the same as that of the solid plate, the elongation per cent. is also the same, and the bend tests are quite as good as those which might be expected from the solid plate. There are several systems in use for welding by electricity which have been employed for a number of years, and are used, among other things, for welding tram-rails in place in making good blow holes, etc in steel castings, and also in welding together pipes, more especially those for refrigerating plant which have to withstand high pressures. But as with the Oxy-Acetylene process, little use has so far been made of these processes in this country for repairing boilers. In the last few years, however, electric welding has been used abroad for this purpose, more especially at Gothenburg in Sweden, where quite a number of boiler repairs have been carried out by this process. The process there employed is somewhat similar to the Oxy-Acetylene process, but the heat is

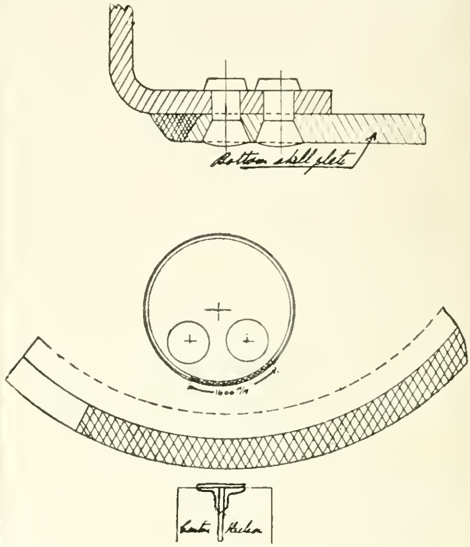
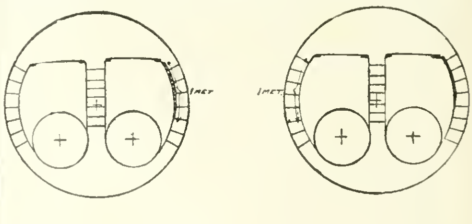


Fig. 13.

generated by the electric arc instead of by the flame from the blow-pipe. The plant there used consists of a barge containing two dynamos of 45 Kilowatt power driven by a steam engine, and a third dynamo of 3 Kilowatt power for



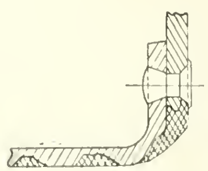


Fig 14

feeding the magnets. The voltage used is between 80 and 120. There are two sets of cables leading from the dynamos, so that work can be carried out at two different places at the same time. The cable from one pole of the dynamo is connected to some part of the boiler and the cable from the

other pole is connected to the welding bar (which consists of a bar of specially prepared steel about $\frac{3}{16}$ in. diameter). This welding bar is fixed in an insulated holder and on being brought into contact with the article to be dealt with and then withdrawn a short distance, an electric arc is formed, which rapidly heats the parts in close proximity to the arc, and at the same time the end of the bar is heated to almost a molten condition; this is then pressed against the parts to be welded, and they being now heated to a welding temperature, a small portion of the end of the bar attaches itself to them, in a similar manner as an almost melted piece of sealing wax is made to adhere to paper; after this small portion of nearly melted metal is attached the bar is withdrawn, thus breaking off the electric current. The added metal is then hammered to ensure its being thoroughly united with the parts to be welded. The welding bar is then again brought into contact with the parts being dealt with, and then withdrawn a short distance to again form an electric arc, and the surface of the metal and also the previously welded metal are again heated to a welding temperature and another small portion from the end of the bar is added and hammered as before, and so the cycle of operations continues until sufficient metal is added for the opening between the two pieces of metal to be entirely filled up, in the case of welding two plates together, or the wasted portions of a plate have been brought up to the required thickness. The following are the results of tests made in June last from a plate welded by this process (and as in the case of the Oxy-Acetylene test samples, are the same as those given at the Institution of Civil Engineers).

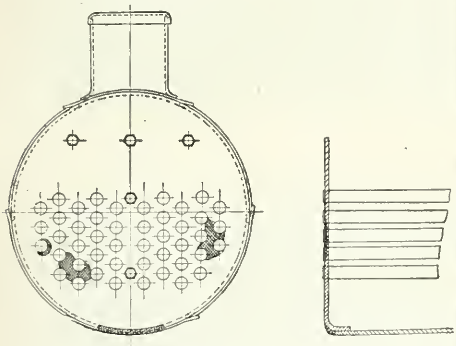


Fig 15.

ELECTRIC WELDING.

	Breadth	Thickness.	Area.	Tons Total.	Tons per sq. in.	Extension in 4 ins. per cent.
	in.	in.	in.			
Not annealed .	1·0	·56	·56	15·35	27·4	12 } Broke
Annealed ..	1·0	·55	·55	14·5	26·3	14 } through weld.

COLD BENDS.

Not annealed .. 58° } Showed signs of
Annealed .... 160° } fracture at weld.

It will be seen that after annealing much better results were obtained than before annealing. But unfortunately one cannot anneal a boiler in place. Some cases of repairs carried out by this process can, I think, be better explained by showing sketches of them. Figs. 1, 2 and 3 are, as already stated, sketches of repairs carried out by the Oxy-Acetylene process, the remaining figures showing repairs carried out by the Electric welding process. Fig. 4 shows the repairs carried out to the two main boilers of a well-known Swedish vessel. It will be seen that these are double-ended boilers. Somewhat extensive repairs were carried out about three years ago (the boilers are fifteen years old) to the combustion chambers and furnace saddle plates, but they had given trouble by leakage, and at the beginning of this year the landing edges of all these patches and also several leaky rivets and local corrosions were welded up by this process; some joints were, as you see, welded up from the under side. I inspected these repairs after the vessel had been running about three months and found there was not a sign of leakage anywhere. Fig. 5 shows a laminated tube plate repaired by this process; the greater part of the lamination was cut away and the plate built up to its required thickness as shown; the small screwed pins shown were put in as a safeguard to avoid any opening up of the lamination, in case it developed beyond what was thought to be its extent. Fig. 6. The landing edge of the lower part of the furnace and also the combustion chamber plating of this boiler in way of same were wasted away, together with the rivet heads, and these parts were built up to their original thicknesses, the rivets themselves being so fused to the plates as to become integral parts of the same. Fig. 7. The landing edges of a leaky patch in the centre furnace of a small boiler were welded to the adjoining plating as shown, also two cracks in the furnace plating and a wasted portion of the bottom seam of the furnace was built up to its required thickness and welded to the adjoining plating. Fig. 8. The plating of this furnace was cracked through and wasted in way of the Adamson rings and repaired as shown. Fig. 9. This shows the furnace of a small boiler which was entirely wasted through in way of the buttstrap and landing edge of the furnace and combustion chamber plating, and was repaired

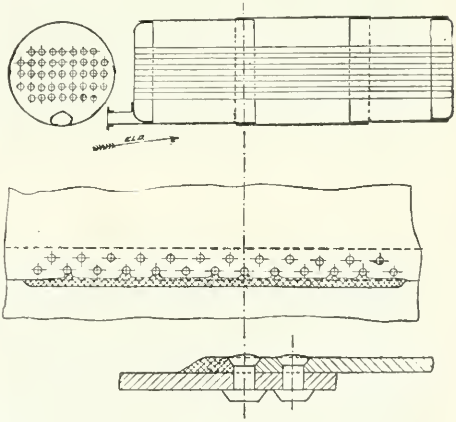


Fig. 16.

as shown, the repairs taking three days. Fig. 10. Here, again, repairs have been carried out to a furnace in way of an Adamson ring. Fig. 11. This shows another repair where the landing edge of a furnace and combustion chamber plating and also a wasted portion of a tube plate were repaired. The tube plate is not rightly shown, as it was on the water side of the furnace. Fig. 12. This plate shows the repairs carried out to the wasted portion of the lower front plate of a marine boiler, it will be seen that the rivets were here welded in to form integral parts of the plate. Fig. 13. This plate shows a repair carried out to the wasted landing edge of the bottom shell plate of another main boiler, where a length of about 5 ft. was built up to its original thickness. Fig. 14. This shows repairs carried out to the combustion chamber plating and tube plate of two boilers which were, as will be seen, considerably wasted and pitted by corrosion, in each case the defective parts being about 3 ft. in length. Fig. 15. This shows repairs carried out to a wasted tube plate of a land boiler and also to the wasted landing edge of the shell plating. Fig. 16. This shows repairs carried out to the wasted seam of a land boiler. In conclusion, I should like to express my thanks to my colleagues, Mr. Bülow at Gothenburg, and Mr. Jones at Marseilles, who have given me the greater part of the information on which this paper has been written.

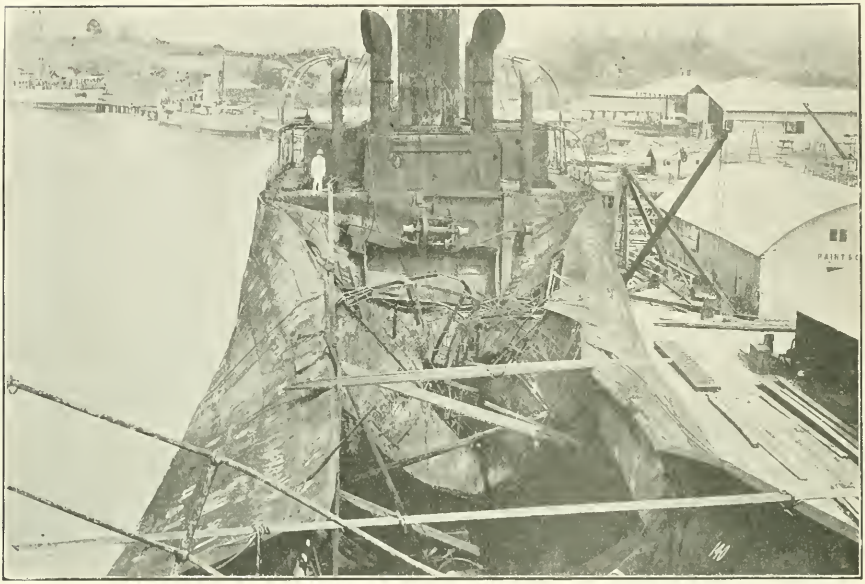


Photo by S. Inouye, Shanghai, China.

The "Netherton."

Photo by S. Inouye, Shanghai, China.

Views showing result of the disastrous Fire on board the "Netherton."

Photo by S. Inouye, Shanghai, China.

The "Netherton."

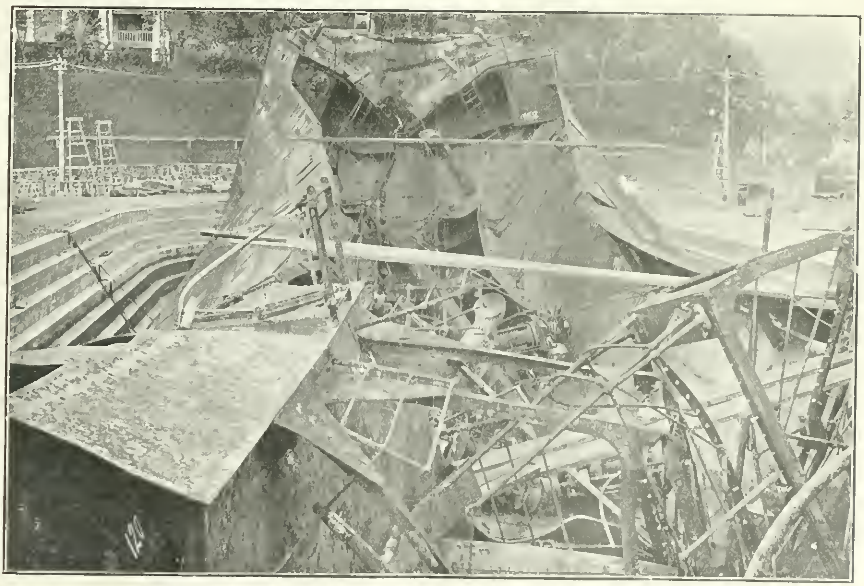


Photo by S. Inouye, Shanghai, China.

The "Netherton" after being on fire.

THE "NETHERTON."

OUR readers may have observed notices which appeared in the casualty lists a few months ago, bearing upon the disastrous fire which took place on board the *Netherton* in January, while loading a cargo of benzine, in cases, at Aroe Bay. There were about 14,000 cases on board, and nearly half of these were destroyed by fire in the fore part of the ship; the coal in the bunkers having also been on fire, the damage to the ship, as well as to the cargo, was very heavy. To facilitate the necessary repairs the *Netherton* was towed to Singapore. The photographs we reproduce are of great interest, showing the condition of the fore part of the ship after the fire, and the buckling effect of the heat. The photographs are by Mr. S. Inouye, Shanghai, China, and have been kindly forwarded by Mr. J. T. Cochrane (Member Inst. Mar. Eng.).

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

AT the end of August I spent the best part of a week at Plymouth and was able to devote a certain amount of attention to the study of the arrangements made with regard to the transfer of mails and passengers by the railway and steamship companies. By the courtesy of the agents of the American Line, I was enabled on the Saturday to go down on the new twin-screw tender *Atalanta*—recently built for the London and South-Western Railway at Dundee, and meet the *St. Louis* in Cawsand Bay. Whilst passengers and baggage were passing from the liner to the *Atalanta* on one side of the ship, the mails were being transferred on the other side to a Great Western vessel in which I recognised an old friend—for the *Cheshire* was once a ferry boat on the Mersey. The disembarkation being rapidly accomplished, the liner slipped off for Cherbourg, whilst the two tenders hastened to their respective docks at opposite sides of the town—the Great Western sending up the ocean mails in one of their non-stop specials, whilst the passengers proceeded by London and South-Western Railway in another special composed of stock specially built for the work. The train was composed of corridor cars and a restaurant—new features to this line. I heard, by the way, that the South-Western contemplates building a sleeping coach for the convenience of its trans-Atlantic passengers. I believe that in the case of the White Star Line the arrangements between the two companies are similar to those in relation to the American Line, that whilst the Great Western takes the mails, passengers are also allowed an option to travel by that Company's route.

On the Monday morning the Royal Hotel was early astir, for the *Kronprinzessin Cecilie*—which I had seen set out on her maiden voyage to New York at the beginning of the month—was expected to be off the breakwater about 6 a.m., and many passengers for this now popular trip to Bremen by N.D.L. liner were staying within its comfortable walls. There were, too, many friends of passengers anxious to get the first glimpse of travellers and there were one or two others beside myself who wanted to get an insight into things generally. So a large party journeyed down in the dawn to the Great Western Dock, where several conveniences for passengers are provided. The Messrs. Davies, agents for the Lloyd and Consuls for half the nations of Europe have comfortable offices and waiting rooms there, whilst the Royal Hotel, of which I have already spoken, has also a room there, where its energetic manager, Mr. Arnold, is ready to take the orders and see to the convenience of those who propose to break the journey at this pleasant and historic port. As our tender passed down to Cawsand Bay, the wooded cliffs looking their best in the early sun, we passed close to the ex master *President Lincoln*, the new acquisition of the Hamburg Line. She was outbound to New York, and was embarking passengers. A little excitement was afforded by the fact that someone fell over-board from her as we passed, and there was a throwing down of lifebuoys and a lowering of boats, which ended in the man being successfully rescued. But we had little time for attending to the ex-Leyland Liner for the *Kronprinzessin* was racing up from the Eddystone and all eyes were fixed on her as she grew up into a thing of grace and beauty. What a contrast to the *President*, with its stumpy masts and ugly deck houses—as the two ships lay near one another one could not help feeling that here were indeed *Beauty* and the *Beast*. I need not again refer to the *Kronprinzessin*, which I described last month, she having made a successful voyage and come home at a fine speed, everyone on board being loud in her praises. She had a good passenger list for Plymouth and a heavy mail, as well as a large quantity of bullion and species. There was a never-ending procession of men taken from every branch of the liner's crew, each with a silver bar on his shoulder passing into the passenger tender, whilst post-office men worked the mails to the starboard side. Yet three-quarters of an hour after we got alongside we were casting off again and, whilst the mails were shifted to the waiting tenders for the last stage of their long journey the passengers and their baggage went through the ordeal of the customs, their special following close on the heels of the mail train for its non-stop run to Paddington.

Atlantic Rate War.

The 1907 season has seen the actual advent of three monster passenger steamers, the *Adriatic* of the White Star Line, the *Kronprinzzin Cecilie* of the N.D.Lloyd, and greatest of all, the *Lusitania* of the Cunard Line, to say nothing of the near approach of the *Lusitania's* sister and the addition of such intermediate vessels as the Hamburg Line's *President Lincoln* and *President Grant*. One might have imagined that the volume of traffic had so much increased that there might have been enough for all, even with this greatly increased accommodation. This, however, does not seem to be Herr Ballin's view, or perhaps it is that he does not see his way to securing as large a proportion of what is passing as he could desire. At all events he is on the war-path again, and now passenger rates for the later part of the winter season are being cut by most New York lines. The lines—such as Cunards—which are heavily booked in advance will, of course, suffer least at first. In this connection it may be remarked that the Nord Deutscher Lloyd has made the announcement that the arrangements for some time existing—whereby return tickets issued by them were available for return by vessels of the Combine's various fleets—have now been entirely cancelled. This intimation may be significant of a further rivalry.

Diving.

The British Navy has rightly been proud of the achievement of raising torpedo boat No. 99 from a depth of 25 fathoms, say, 150 feet. But if news from America be reliable a new record has been created by a dive to a depth of 230 ft. off Long Island. This feat was accomplished by the use of a diving suit of a novel design, it being made of thick steel instead of rubber and canvas, as is the usual practice. The success of such an invention as is here indicated will almost certainly stimulate attempts to salve treasure from old wrecks whose whereabouts is known, but whose position is such as to have been unapproachable with ordinary appliances. Indeed, it is already stated that an expedition is to be despatched to Venezuela to attempt the recovery of the treasure said to be aboard the old ship *San Pedro de Alcantara*, sunk in the harbour of Cumara some ninety-two years ago.

The P. & O. Company

has recently issued two little booklets. One of these gives the itineraries of their steam yacht *Vectis*—probably the most successful and certainly one of the most comfortable of public yachts.

The other pamphlet contains illustrations of the more modern vessels of the fleet, including those of the "M." and "D." classes of mail steamers. Like the Cunard Company, P. & O. has recognised that passengers cannot be put off nowadays with much gilding in the saloon and take that as the measure of comfort in a ship. People nowadays, accustomed to a high standard of comfort at home and in

ANDREWS' PATENT GOVERNOR.

THE governing of a marine engine is a subject which has interested generations of engineers. It has afforded hundreds of inventors a problem of great difficulty to solve, and the world as a result is presented with a large number of devices designed to effect the purpose, but with very varying success.

It is not certain whether shipowners, who are really more interested in this question than other people, quite fully appreciate the importance of a really efficient governor for marine engines. The result of racing is strained engines, broken shafts and loose seats. The flaw in a shaft is no doubt often started by some abnormal strain, and its extension is only a question of a certain number of impulses before final fracture takes place. For example, a flaw may

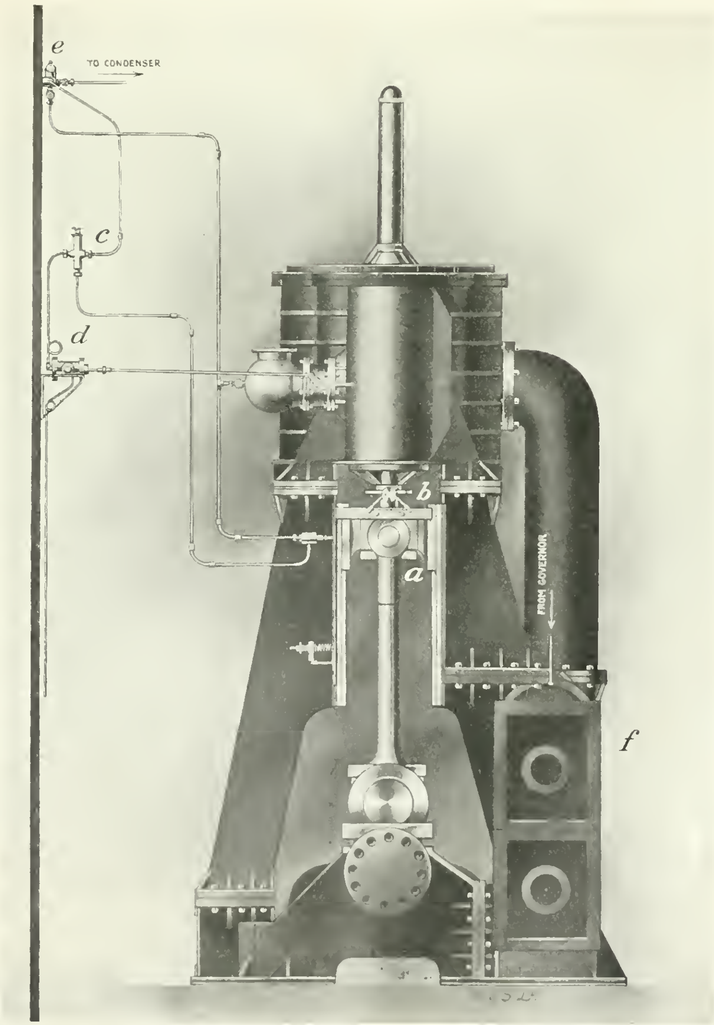


Fig. 1

be started in heavy weather, while the shaft finally fractures months afterwards during ordinary conditions, hence to prevent abnormal strains in the machinery effective governing is of immense value to the shipowner, as apart from the expense of installing a new shaft, the loss of earning capacity by the ship lying up is a serious item. Again, when on a voyage if the governing of the engines can be absolutely and automatically controlled in a reliable manner within safe limits, much better speed can be maintained, and the saving in coal and time thus effected carries with it the corresponding saving in cost of running the ship, including the feeding of the whole ship's company. Then above the commercial considerations there is the predominant one of safety of passengers and crew, and it will be recognised that an efficient governor is an important factor in this matter.

It is not proposed to go into the merits or demerits of known systems, but rather to point out what has been done by the Andrews Governor Patents, Ltd., of 64, Victoria Street, Westminster, S.W., and Lower Road, Deptford, in the direction of the provision of apparatus of a simple and reliable character which will govern a marine engine and prevent racing, either from the submergence of the propeller being varied or from other causes, which may relieve the engine of a part or the whole of the resistance against turning.

It was in the year 1903 that the company's first patent was taken out for a governing apparatus, which consisted of a pump driven by the engine, an adjustable bye-pass controlling the velocity of the fluid driven by the pump, and a power device or controller operated by the fluid against a reacting resistance adapted to operate the throttle valve of the engine. This device deals with the problem on an actual increase of speed first taking place.

In 1905 a further patent was obtained for a device acting in conjunction with the governor by which the submergence of the propeller was anticipated, and the steam was automatically cut off sufficiently ahead of the actual reduction of resistance as to prevent racing

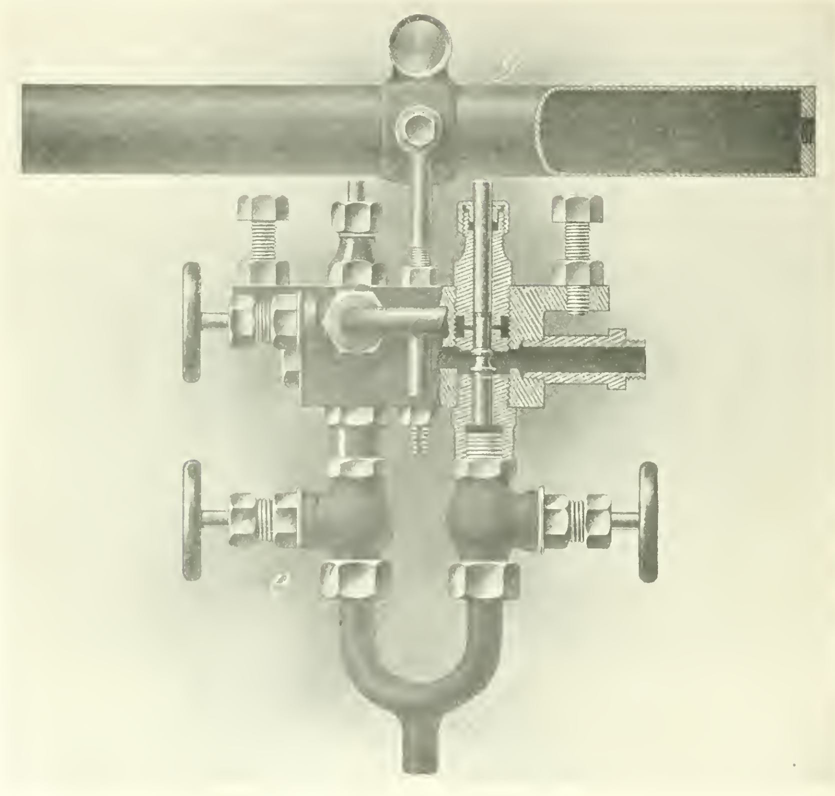


Fig. 2

owing to the amount of steam which would be left in the cylinders, valve chests and receivers at the time of such reduction, unless such were anticipated.

This device, which is called an "anticipator," consists of a tube adapted to pivot about a transverse axis relative to the ship and containing a certain quantity of mercury, is arranged to normally keep a control valve on the seat; but when by the motion of the ship through any more than a minimum angle of inclination the mercury is sent by its own momentum from one end of the tube to the other, the tube is tilted by gravity, and the valve held normally by it is then released and fluid under pressure is allowed to pass to the controller to operate the throttle valve. This device thus deals with an anticipated increase of speed by the action of the inclination of the ship either from head or stern seas.

Both these governing devices have given excellent results in practice, and many steamers are fitted with them.

It has been found as a matter of practice, however, that very large steamers, owing to their length, will travel through seas without any material inclination to the horizon, with the result that the propellers are submerged more or less in depth as they pass through the waves, and the engine resistance is varied accordingly. In order therefore to meet in a complete and simple apparatus, all the possible conditions likely to

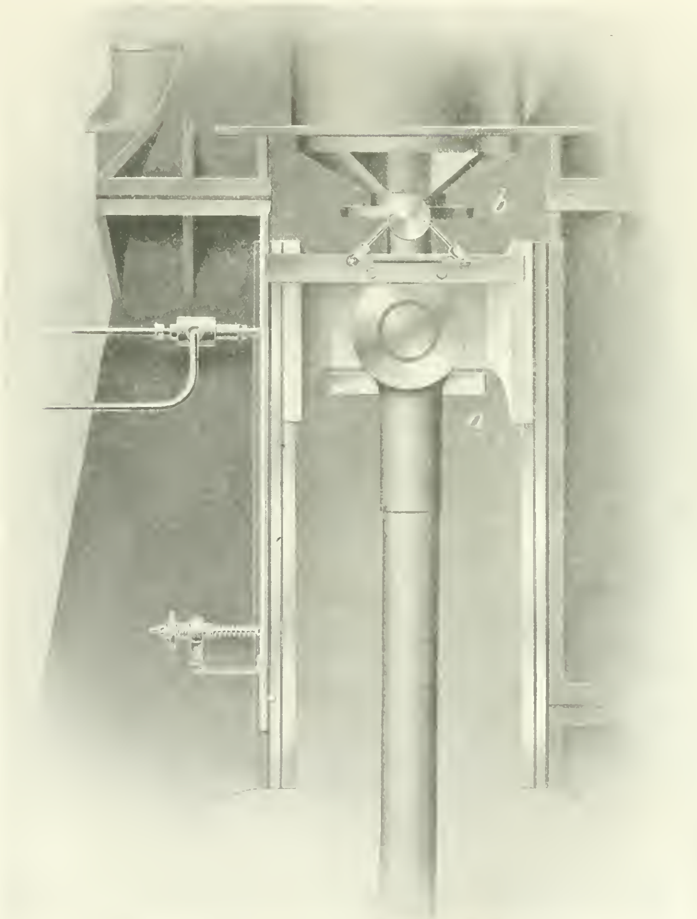


Fig. 3.

obtain when an increase of speed results from any cause whatever, a new form of governor arrangement has been devised, which consists essentially of a momentum governor operated by the engine, an anticipator operated by the inclination of the ship, an automatic bye-pass adapted to cut out the anticipator when the momentum governor is operative, and a power device for operating the throttle valve from any source of fluid pressure.

By reference to the adjoining diagrams the general arrangement of the device is shown, as also the constructive details of the essential parts.

Figure 1 is a general end elevation of a marine engine with the combined governor applied thereto.

Figure 2 is a part sectional elevation of the "anticipator."

Figure 3 is a detail view of the momentum governor and its gear.

Figure 4 is a sectional view of the automatic bye-pass valve.

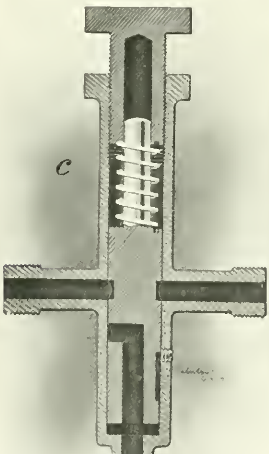


Fig 4

Upon the crosshead *a*, or other convenient reciprocating part of the engine, is a momentum governor *b*, consisting of a bar to which is pivoted a second rod attached to a weight, and this weight is pivotally connected by a rod with a sliding sleeve carried by the crosshead bar, while a spring attached to the sleeve enables the effect of the weight on the sleeve to be modified according to circumstances by varying its tension. Upon the framing of the engine a rod is pivoted of such a length as to allow the sleeve to co-act with the rod for the whole length of stroke of the engine when the governor is operated on excessive speed being attained. At the lower end of the rod a fixed stop is arranged on one side, and on the other side an adjustable re-acting spring is provided, whereby the force against which the sleeve acts can be regulated.

The adjustable re-acting spring consists of a fixed support into which is screwed a stem having a hand wheel, and through the centre of the stem a rod is passed which is fixedly supported in the pivoted rod. Upon the central rod a spiral spring and a nut are threaded. The pivoted rod carries a spring detent, which engages the fixed support on any excessive acceleration of the engine.

In proximity with the pivoted rod a valve is arranged and connected to a source of fluid pressure, such as the steam pipe, the pressure tending to keep the valve closed. The rod, when moved about its pivot, against the re-acting spring, co-acts with the valve and opens it, allowing steam to pass to the automatic bye-pass valve *c*.

The bye-pass valve *c* consists of a casing containing a piston sliding therein and having three branches. One branch is to admit steam under the piston. The piston has a groove, round which communication is made between the two opposite branches, and also has a central passage leading to a side passage adapted to communicate with the right-hand branch when the piston is forced along by the steam pressure against the pressure of a spring adjustably supported by an adjustable cover. In this latter position of the piston the left-hand branch is entirely closed. A pipe, preferably of a flexible character, leads from the right-hand branch to an oscillating cylinder *d*, mounted on suitable supports on the bulkhead, and the piston rod is connected by a rod with the lever of the throttle valve. The lower branch of the bye-pass valve *c* is connected with the body of the "anticipator" *e*, which is supported in any convenient manner upon the bulkhead or other support, so that the axis of the device is parallel to the keel of the ship.

The "anticipator" consists of a valve box having duplicate valves, one being for "head seas," and the other for "stern seas." Each valve can engage an upper and a lower valve seat. The upper valve seat communicates with a space leading to a stop valve connected with the condenser *f*. The lower valve seat is in communication with another stop valve connected to the steam supply. Upon the upper part of the valve box a tube is mounted upon bearing pins carried in supports. The cradle in which the tube *g* is supported is capable of expansion and contraction by means of an adjusting screw, whereby the position of the tube *g* can be adjusted relative to the axis of movement to adapt the device for "head seas" or "stern seas." The tube *g* contains mercury or any equivalent mobile body or bodies, and the momentum of the mercury varies the position and action of its weight on the stem of the particular valve then in use, maintains the valve on its lower seat, and prevents the passage of the live steam, until such time as the weight of the mercury has been removed by the inclination of the ship having caused the mercury to run to the opposite end of the tube *g*, and tilting the latter about its axis. In this case the live steam passes by the automatic valve *c* to the cylinder *d*, and operates the throttle valve. On the reverse movement of inclination the mercury resumes its former position, and the tube *g* closes the valve on the steam valve seating and opens the exhaust valve seating, thus

putting the cylinder *d* in communication with the condenser, which causes the throttle valve to open. Adjustable stops are provided on each side to regulate the inclination of the tube *g* to the line of the keel. This "anticipator," therefore, controls the speed of the engine on any material alteration in the trim of the ship.

When the engine is accelerated from other causes than the above, on the next up-stroke of the engine the weight on the crosshead moves relatively downwards against the tension of the spring, and forces the sleeve outward so as to contact with the pivoted rod. This action causes the rod to turn on its pivot and open the valve, admitting live steam to the automatic bye-pass valve *c*, operating its piston, cutting off the connection of the cylinder *d* with the condenser, and admitting live steam to the cylinder which closes the throttle valve. Immediately the speed is reduced (assuming it has not been abnormally excessive so as to cause the spring detent to act), the pivoted rod reverts to its normal position, the valve closes, and the automatic bye-pass valve is returned by its spring to its normal position, putting the cylinder *d* in communication with the condenser *f*, and opening the throttle valve.

On the under side of the cylinder *d* is provided at a convenient point a drain pipe, which not only enables the condensed water to escape, but also allows the steam to get away when the piston of the cylinder *d* has travelled along so as to uncover the drain orifice.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

WORK here is quite brisk and every dock is occupied, while to cope with the large amount of refitting, about two hundred men have been taken on. Beyond the fact that our new battleship is to be commenced about the middle of November, very little is known. She is to be larger than the *Dreadnought*, but whether she will carry 12-inch guns as her main armament or the new 13·5-inch is not known. Several innovations, suggested by the experimental trials with the *Dreadnought*, are also to be introduced. The two-year limit for completion is to be adhered to, although it was recently reported that the Admiralty had abandoned this limit in connection with the *Bellerophon*. That vessel was undocked on September 4 and taken under the big shears to have her boilers and heavy machinery lifted into position. Work on her is proceeding apace. Her sister vessel, the *Dreadnought*, will remain here until November, at least, for not only is she to have a new steering engine, but there are to be other alterations of an experimental character, after which she is to undergo further trials. The dock vacated by the *Bellerophon* was utilised for the battleship *Hindustan*, of the Channel Fleet, which was placed there for an examination of her under-water fittings. The battleship *Glory* and the cruiser *Cressy* have had their defects made good. The former has gone to the Mediterranean to relieve the *Venerable*, which comes home to join the Channel Fleet, while the latter has joined the Fourth Cruiser Squadron in place of the *Sutlej*. The *Good Hope*, flagship of Rear-Admiral Sir Percy Scott, of the First Cruiser Squadron, has not quite completed her refit. The cruisers *Eclipse* and *Spartiate* and one or two smaller gunboats are also in hand, as well as a number of destroyers and submarines. Submarine C 11 arrived here from Messrs. Vickers, Sons and Maxim, Barrow, on September 5, and there is now only another of the C class to deliver. I hear that an experimental boat is being built at Barrow, which is said to be a much larger boat of more power and greater speed. The present submarines have two torpedo tubes forward, but the new vessel is to have three—two forward and one aft. Preparations are being made for constructing the new lock, and orders have been given for the coal accumulated at the coaling point to be cleared away. No time has been lost in getting on with the extension of the building slip. After the *Dreadnought* was launched fifty feet were added, but the old armour-plate shop was in the way of any further extension. The shop has now been removed and arrangements are being made for the other fifty feet to be added. The work will not interfere with the commencement of the new ship, even if it is not completed by November. The work of laying concrete blocks across the Horse Sand will shortly begin. They are to be dropped at intervals of about 45 feet, the object being to make it impossible for any vessel to dash across the sandbank at high tide and get into the harbour. The blocks will practically constitute a breakwater extending from Southsea to the harbour channel, and this will be the only channel through which a ship coming round the Isle of Wight can gain entrance to Portsmouth. Some openings marked by beacons will be left, so that small craft can get through, but should the defences of the port be mobilised they would be blocked up. It is worthy of note that three of the four Whitworth scholarships competed for this year have been won by engine fitter apprentices at Portsmouth Dockyard and School—Messrs. Hudson, Perryman and Warren. This, it must be allowed, is a remarkable achievement, seeing that the scholarships are competed for by the best students of engineering throughout the country.

Chatham Dockyard.

We had a visit at the beginning of September from Mr. Marshall, the Director of Dockyards, who conferred with the officials as to the work we are to do in connection with the cooling of ships' magazines. For this purpose the Admiralty have made a supplementary grant of £21,500 to the wages vote, and several ships are to be taken in hand during the present financial year. It is expected that a system of tanks, fitted with boiler tubes, by which the air will be cooled, will effectually ventilate the magazines and remove all source of danger. The effect of this grant will be to bring the wages bill to nearly £500,000, as compared with £575,000, the average for the last five years. The most prosperous of recent years were 1904-5 and 1905-6, when the wages were over £600,000. We are fairly busy. The *Cochrane*, of the Fifth Cruiser Squadron, is making a short stay, and the *Roxburgh*, which has been temporarily relieved in the First Cruiser Squadron by the *Donegal*, is being refitted, after which she will proceed to Devonport. The *Tyne*, depot ship for destroyers, which has been transferred from the Home to the Channel Fleet, is also refitting, and the cruiser *Latona*, from Portsmouth, is being fitted as a mine-laying ship. Although the cruiser *Sutlej* has only been out of dockyard hands for a short time she has returned for an extensive refit. On her previous visit she was only patched up, but now she is likely to be here for a considerable period. Her machinery has not been at all satisfactory and it is to be given a thorough overhaul. Her place in the Fourth Cruiser Squadron has been taken by the *Cressy* from Portsmouth. The cruiser *Blenheim*, which has been fitted up as a seagoing repair vessel, is to be moored in Harwich Harbour in the position once occupied by the *Fisgard*. New moorings are being laid down there for destroyers, and preparations are also being made for the reception of the six submarines of the C class, which, with their parent vessel the *Thames* which has arrived here for some alterations, are to make Harwich their head-quarters. The battleship *London* has returned here with a machinery defect and the *Swiftsure* is also here. It is only a few weeks since the *Triumph* left and now her sister ship is undergoing a thorough overhaul. During the *Swiftsure's* stay alterations are to be made to her fire-control fittings and her 12 pounders are to be removed from the main deck to the shelter deck. Her refit is expected to be completed about the beginning of November. The battleship *Africa* also paid us a short visit to be docked. The vessel had not been docked since she was in collision with the *Ormuz* and the examination was made, I understand to see if she had been damaged under water in view of a pending law suit. The depot ship *Pembroke*, while lying at moorings in the Medway, was run into on September 11 by

the screw collier *Walton*, which necessitated the *Pembroke* being placed in dry dock. The damage was not serious. She was struck on the port quarter, and one of the plates broken just on the water line. The collier continued on her voyage apparently uninjured. The *Pembroke* is a third-class gunboat and was formerly known as the *Trent*. It has now been definitely settled that the Gunnery School is to be moved from Sheerness to Chatham in June next. Various other changes will be necessary in connection with the removal, and these are under consideration by the authorities. The removal will be a distinct gain to the town. Our admiral superintendent, rear-admiral Giffard, has been promoted to vice-admiral, and, as Chatham for many years has been a rear-admiral's command, it is likely that he will soon leave us. He only came here in February on the death of Rear-admiral Corry, and the hope is generally expressed that his advancement will not involve a change in command after such a short time. Up to the time of writing no official announcement has been made as to his leaving.

Devonport Dockyard.

The *Téméraire* is making good progress. On one day in September (the 12th), eight barbette armour plates, weighing approximately seven tons each, and the same number of side armour plates were fixed in position. A crane capable of lifting thirty tons has been fixed alongside No. 8 Dock at the Keyham Extension, in which the *Téméraire* is to be placed. The date for the steam trials of the cruiser *Minotaur* has not yet been definitely decided. The delay will defer the commissioning of the ship until March, instead of October, as originally expected. A singular accident was reported to have occurred on September 12 to the vessel. According to the story, about noon, the tide being at the ebb, it was found necessary to bring the *Téméraire*, which was alongside the jetty at the South Yard further forward, and to do this the *Minotaur*, which was lying at No. 2 Jetty, had to be shifted and her stern moved nearer the middle of the Hamoaze. This was done by the aid of a tug, and the *Téméraire* was placed in position. The change necessitated the *Minotaur's* bow being brought closer to the jetty than is usual, and the result was that her bow grounded on the lower ledge of the jetty. This was discovered shortly after she took the ground and a tug was brought into requisition before she refloated. Now this story is inaccurate from end to end and it would interest the dockyard officials very much to know how it came to be put about. The battleship *Commonwealth* has returned here in consequence of having grounded at the entrance to Lamlash Harbour. At the court martial, the court found the charge against the captain of stranding the ship by default proved and the charge of negligence not proved. He was sentenced to be reprimanded. The charge against Lieutenant Brabant, who was temporarily acting as navigating officer, was not proved and he was acquitted. Torpedo boat No. 99, which sunk recently off Berry Head, was, as I said last month, raised, and she was towed here from Torquay on September 11. The after part has not yet been recovered, but it is understood that if it is salved, the repairs, although they will be extensive, will present no insuperable difficulty. Commander Gilpin Brown, the assistant to the captain of the dockyard, Lieutenant Mann, the master rigger, and all engaged in the work are to be congratulated. In the first attempt to raise the vessel in June, it will be remembered a diver lost his life, in spite of the heroic efforts of a comrade to save him. From an economic point of view, perhaps, a torpedo boat is not worth the trouble and expense involved in salving; but the experience gained in the use of new craft appropriated for raising sunken vessels will be worth something. Captain Horsley, the captain of the yard, has reached flag rank and his promotion has necessitated his relinquishing his post, which he has held since July, 1905. His successor is Captain Ommanney, from the battleship *Britannia*. He is somewhat familiar with his new duties, as he was four or five years ago staff captain of the yard and Queen's harbour master for the Hamoaze. Rear-admiral Horsley, although promoted on September 1, did not leave until the 20th. I have some news of Rosyth, the proposed new naval base in the Firth of Forth, which will be of interest to the other yards. Captain Travers, skipper of a dredger at work in Scotland, who has been in Plymouth on business, says he expects to receive orders shortly to proceed to Rosyth. He speaks in high terms of the natural position of Rosyth as a naval base, and is of opinion that in a few years, after dredging and dock building, it will equal any of the southern dockyards.

Sheerness Dockyard.

The harbour has been practically denuded of ships lately. The battleships of the Home Fleet left on September 3 for a three weeks' cruise in the North Sea and the Fifth Cruiser Squadron went out for a fortnight's cruise a day or two later. The destroyer flotilla of the Home Fleet, which went for a three weeks' cruise in the North Sea at the end of August has returned. A sad boating mishap occurred on September 6 in the Firth of Forth, three men of the destroyer *Wolf* being drowned. The *Myrmidon* of the First flotilla has been sent here from Portsmouth for her boilers to be retubed. She is fitted with Reed water tube boilers, and on the completion of the retubing she is to join the Channel Fleet, to which the First and Third Destroyer flotillas and their attendant vessels are now attached. The cruiser *Thames* and her submarine flotilla returned to the Medway on September 1 after a five weeks' cruise, during which the vessels were exercised along the east coast and also visited the Firth of Forth. The flotilla attracted much interest in the east coast rivers, as this was the first time that such vessels had cruised in the North Sea. The refitting of the submarines is to be taken in hand singly, while the *Thames* has gone into dockyard hands at Chatham, there being no dock here long enough to accommodate her. Admiralty House is again occupied. The offices of the commander-in-chief of the Home Fleet have been transferred there from the battleship *Dreadnought*, and on September 11, Vice-Admiral Sir Francis Bridgeman took up his residence in the building so long occupied by the commanders-in-chief at the Nore. It was originally erected, it is interesting to recall, as a nautical palace for King William IV. when he was Duke of Clarence. The *Dreadnought* will not begin duties here as flagship for some time yet as further experiments are to be made with her at Portsmouth in order to gain experience for the best type of fittings for her improved sisters. Commander Forster, who has been here since the beginning of 1904, leaves us on October 1 to take command of the torpedo depot ship *Tyne*, which, when she has completed her refit at Chatham, is to join the Channel Fleet. Commander Forster at first had charge of the Dockyard Reserve, but on the retirement of Staff-Captain Chambré the staff-captain's branch and the Dockyard Reserve were amalgamated, under the title of the Commander of the Dockyard's department. His successor will be Commander Lacy, who recently commanded the *Emerald* at Queenstown. The appointment of Mr. John Apsey as constructive manager at Portsmouth has given great satisfaction to his friends here, who have watched his career with interest from the time he entered the yard as a shipwright apprentice. Mr. Apsey went from here to the Royal Naval College at Greenwich nearly thirty years ago. Several who were apprentices with him are now occupying prominent positions in the service, Mr. Richards being constructive manager at Devonport and Mr. Pledge chief constructor at Pembroke.

Pembroke Dockyard.

It appears to be imagined in some quarters that Devonport's new battleship the *Téméraire* is the heaviest vessel ever launched from a Royal dockyard, her launching weight having been 7,475 tons, 500 tons in excess of her sister ship the *Bellerophon*. Other yards may hold the record for rapid building, but Pembroke holds the record for launching the heaviest ships. The battleship *Hannibal* launched here in April, 1896, weighed 7,900 tons, and the cruiser *Defence*, 8,014 tons. This is accounted for by the fact that at this yard it is usual to fit the side armour in the building slip, whereas at the other yards, which have large floating basins and dry docks, the principal part of the armour plating is fitted after the ships are launched. In the case of the *Defence* almost all the side armour and all the armour of the ten 7·5-inch gun barbettes was on board at the time of launching, whereas the *Téméraire*, which is the same length as the *Defence*, but with seven-and-a-half feet more beam, had only a few of the armour plates on her sides when she was launched. All four funnels of the *Defence* have now been fitted and this completes the shipment of the main portions of the machinery and boilers. All the parts of the propelling engines have been connected up and the bed plates secured to the engine

bearers. The boilers are also being secured, and the main steam pipes have been carried through the greater part of the five stoke-holds. Electricity will be extensively used as a motive power, and both the forward and after capstans will be electrically driven, the *Defence* being the first ship built here in which the fore capstan has been so driven. With the exception of one specially large dynamo and dynamo engine all the auxiliary machinery is in place. This dynamo is being provided owing to the special fan installation for the boiler rooms which has been fitted, and to other extensions in the electrical system, which rendered the three dynamos originally provided insufficient. The *Boadicea* is making satisfactory progress. The framework and the lower deck beams between the fore side of the engine room and the bow are in place and the stern post is in position. The plating of the outer and inner bottoms and of the lower deck is being proceeded with. The ship was begun by Mr. Worthington, but building operations are now under the direction of Mr. Nicholl, the assistant constructor. The date of the launch will not be definitely fixed until after the new chief constructor takes over his appointment (he should have arrived by the time this is in print), but it will without doubt be some time in March. During that month the *Defence* will leave for her steam trials, and the *Boadicea* can then be berthed at the Carr Jetty to receive her boilers and heavy machinery. This can be completed by the time the *Defence* returns and the *Boadicea* will then be dry docked for completion. The order for fenders, floating stages for submarines, and pontoons, placed here three or four months ago, averted a reduction of mechanics, as there would have been a difficulty in disposing of all the men who were employed on the *Warrior* previous to her departure in June. I hear that the armoured cruiser *Aurora*, which was built here twenty two years ago at a cost of over £300,000, is to be sold out of the service in October. She has had a varied and interesting career. The *Aurora* is one of the belted cruisers built from the designs of Sir Nathaniel Barnaby, and she has been laid up for some time in Holy Loch with a number of other obsolete vessels. It is not often that dockyard employees are selected for the honour of being placed on the Commission of the Peace. Mr. John Rowlands, chargeman of shipwrights, and Mr. Henry Trevena, retired dockyard writer, have, however been appointed Justices of the Peace for the borough of Pembroke. Both are dockyard apprentices. Mr. Rowlands is, I believe, the first dockyard employee upon whom such an honour has been conferred.

VENTILATION AND SANITATION.

By MR. A. E. BATTLE (Member of Council), Inst. of Marine Engineers; Member of the Royal Sanitary Institute.

PURE air is as essential for health at sea as on shore, and the various branches of sanitation require equally as much, in fact more study and attention on ship board than on land, owing to the confined spaces and peculiar and varying conditions.

The idea that sea air solves all hygienic difficulties, the apparent belief in its magical purifying properties, I am sorry to say, must be refuted as ridiculous and absurd, born only of human inclination to be contented with any and every conscience-quelling possibility, in the endeavours to obtain economy, yes, economy, so called, apparently at any costs.

The blind following by precedent, together with the fact that men still follow the sea calling, and perhaps the fact that public attention is not continually riveted upon individual vessels is possibly accountable for the lack of even an attempt, in most cases, at efficient sanitary arrangements (by sanitary arrangements I mean the term in its broadest sense). In other cases money has been spent in purchasing and equipping desirable apparatus, but a want of care and knowledge on the part of the builders often results in frustrating the ends desired.

* Read at the Engineering and Machinery Exhibition, Olympia, London, before the members of the Institute of Marine Engineers on September 28th.

This lack of the combined knowledge of sanitary science, together with that of the internal economy of all types of modern steamship, induces me to confine myself this evening to the subject of ventilation and heating, together with berthing arrangements on board ship.

It is surprising that more attention has not been paid to this subject, when it is considered what an exhaustive amount of literature has been written on ventilation ashore. This want of special knowledge is therefore my excuse for referring to the elementary principles of ventilation and practices ashore, as, may be, suggesting to the ever-fertile brain of the naval architect and marine engineer, possibilities of their application for marine purposes, or, at least, that as ventilation is so necessary ashore it is possible that those magical purifying properties of the ocean air may not have so beneficially affected, as apparently has been too frequently fondly imagined, the foul and polluted air the other side of even a very thin mild steel bulkhead

I must ask your indulgence if I repeat somewhat certain sections of my previous lecture: "Sanitation as Practised in the Mercantile Marine," delivered in this hall last year.

Everybody will agree that, at least ashore, pure air is essential for health, together with equality of temperature, also that in certain occupations the matter of ventilation requires special attention and consideration. I would also venture to suggest that, for the safety of the public and their property, the berthing of officers and men on board ship should be such as will allow their taking healthy rest, and also that in such places where men are employed on watch, such as in the engine room, etc., ventilation should receive careful consideration. For to keep a watch of four hours in a close and heated atmosphere, where ventilation can best be described as nil, after sleeping in a badly ventilated and badly situated berth, requires considerable effort on the part of the officer in charge to keep from napping on his watch, for he is only human. And I venture to say that if such a case were investigated by unbiassed mind, the verdict would be in favour of the unfortunate culprit, and a condemnation of the ventilation system.

We inhale in the course of twenty-four hours 480 cubic feet of air per minute when at rest, and more than double this amount when at ordinary work. The process of the purification of the blood is outside the sphere of our present investigation, and if any of my hearers are not already acquainted with the same, it commends itself to your investigation. The form and type of air impurities however, certainly demand attention.

The impurities of the air vary greatly with the local conditions. It is worthy of passing note that CO_2 when present in the atmosphere in excess of ·04 per cent. is considered an impurity, and that when present in the atmosphere in ·06 per cent. it indicates the permissible limit of air pollution in accordance with the best hygienic practice; ·06 per cent. of CO_2 is therefore termed the Standard permissible impurity. Carbon dioxide is of itself harmless in quantities likely to be encountered in the atmosphere, but the fact that all increase of dangerous impurities is accompanied by a corresponding increase of CO_2 decided this selection.

On shipboard such a standard as the above might hold good in saloons and in some cabins; but I doubt whether, in the bunkers of a ship, or in the stokehold or engine-room, the increase of the dangerous impurities could be so indicated by the presence and quantity of CO_2.

The conditions of ventilation of a bunker are not, as a rule the best. It would be of advantage if the bunker doors were open to allow an air current to pass up through the coal. I have here an apparatus consisting of a U tube filled with fine coal dust; it will be observed that when the air pressure is most slightly disturbed in the one tube by means of this indiarubber ball the indicator at the other side shows clearly that the air current freely passes through the coal.

I cannot impress upon those in authority too forcibly the necessity of providing through wind current in bunkers, even if at a little discomfort to the berths in close proximity to the bunker hatch. For down there in the dull black bunker the conditions of working are, if anything, worse than a coal mine itself.

But confining myself for the present to such conditions as prevail in saloons and sleeping berths, the land rules may apply. It is estimated that to keep the standard of impurity of the atmosphere to within ·06 per cent. will require for each

person 3000 cubic feet of air per hour. Upon this is based the deduction of the cubic space required per individual. Now, the space required is a matter dependent upon the facilities for changing the air, and providing the changes can be satisfactorily effected, the Board of Trade allowance of 72 cubic feet per man might be termed a luxury. In fact a mere box would suffice as a sleeping compartment. But unfortunately the rate of air change is very limited, temperature playing no small part in this direction. Air travelling at 1½ feet per second is not perceptible and even at two to three feet it can not be said to cause a draught. This would perhaps suggest that all air should be heated in a system of marine ventilation, on account of the limited space and the consequently many changes required to maintain anything like a satisfactory standard of purity.

A change of air three times an hour is all that can be borne under ordinary conditions, and with such conditions the space required per individual would be 1000 cubic feet. The authorities have thought fit to allow Tommy Atkins when in barracks 600 cubic feet, and the common lodging-house, where a considerable number of our firemen collect when ashore, 300 cubic feet per man, and viewing the above facts, the basis of 72 cubic feet, as allowed by the Merchant Shipping Act, is surprising. It would be certainly interesting to know the field of research whereby it was discovered that men at sea could under certain conditions apparently be, shall we say, content, with such a limited space.

The usual method of deducting the air space required is of itself instructive and interesting, namely,

The amount of CO_2 given off by one person.

Possible maximum quantity of CO_2—CO_2 in 1000 cubic feet of air = Air required per individual.

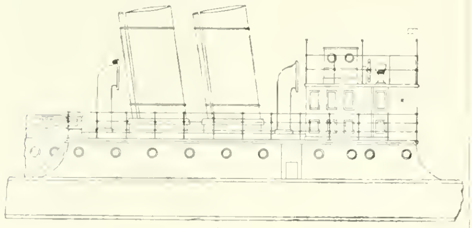


Fig. 1

The rules for computing the air space on board ship is laid down in the Board of Trade instructions to surveyors, and can be broadly stated as the most that can be made of the floor space in square feet independent of its utility, divided by 12, providing always that the cubic capacity does not fall short of 72 cubic feet per seaman after deduction has been made for certain encumbrances, such as hatches and ventilating trunks. For some reason, however, spaces occupied by bunks are not deducted.

It is a noteworthy fact that builders fit the maximum number of berths allowed by the Board, independent of whether that number of crew are to be carried or not, and so greatly reduce the all-too-small air space accordingly. Perhaps it is to induce the owner to carry a larger crew, for we know that quite a number of owners realize that the Merchant Shipping Act complement of men is small, and for this great blessing (for it is a blessing, we who go down to the sea in ships are duly thankful. But why any berth should be a fixture, built in in such an unmovable fashion, apparently on the same principle as the laws of the Medes and Persians, is a question perhaps the shipbuilder can best answer. Why cannot the great improvements effected ashore in this direction be adapted to ship requirements, and upon that basis I would suggest the following rules, in connection with ships' bunks, as a possible guide to health and cleanliness generally.

1st. All bunks should be constructed clear of the ships' side or bulkhead to allow a free circulation of air.

2nd They should be placed for preference against the inner bulkhead; that is, not against the ship side.

3rd. They should all be removable, the framework of iron and wire springs substituted for the usual wood lathing. The sides or bunk boards not more than 8 inches deep. The foot and head boards to be carried to within 6 inches from the deck above. The minimum dimensions being 6 ft. 6 inches long by 2 ft. 3 inches broad. The bunk to be as much above the deck as possible.

The cubicle system of crew accommodation, however, is preferable, possessing more of the civilized element, and the class of men following the sea, who live forward, would undoubtedly improve if the conditions of living were more pleasant.

Stringent regulation should be enforced regarding fitting lockers under bunkers or obstructing the free circulation of air by stowing boxes and the like under bunks in both cabin and forecastle.

The farce of morning inspection of a ship by a commander ignorant of the elementary rules of sanitation, or a medical man who, with few exceptions, is ignorant of the internal economy of a modern vessel, generally results in discomfort only, and is productive of very little good.

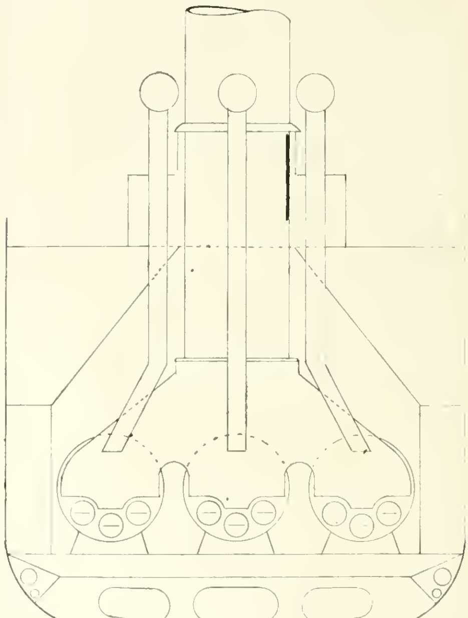


Fig. 2.

The ordinary attempts at ventilation on board ship must, to use the mildest language, be termed ill-directed, possibly from a combination of want of thought and want of special knowledge. Conformity to the letter of the Merchant Shipping Act with regard to ventilation, irrespective of the elementary principles governing the position of ventilators, etc., in many cases is all that one finds, and ventilators are more often so arranged as not only to be useless, but a source of annoyance when anything but the mildest weather is encountered. In some cases ventilators discharge directly over a bunk. The natural consequence being it is kept plugged up from below to prevent intolerable draughts. This arrangement is more often than not due to the absurd notion of sacrificing all for appearance on deck, a condition which must give way to utility and practical science as it did under compulsion, when the black smoking funnel found a place on the before spotless deck to lay smuts belched forth with clouds of black smoke, and covering with soot, masts, riggings and sails alike.

Sir John Clarke, one of the leading authorities on hygiene, says: "Air, as it increases in temperature, or becomes loaded with watery vapours, has its weight diminished and ascends. Now the air in an inhabited apartment, being both heated and generally combined with a portion of watery vapours from respiration, etc., becomes specifically lighter, at the same time that it is vitiated, and rises to the roof. If it is given the means of escape it would be gradually forced out by an equal quantity of pure and more dense air entering from below, which in its turn becomes heated and deteriorated, would in like manner ascend and make its escape, thus would

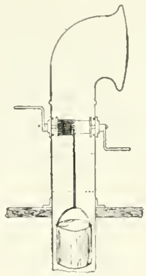


Fig. 3.

a continual current of the air circulate without any trouble on our part. Unless provision be made for the escape of the ascending current of impure air, no admission of external air will secure proper ventilation."

This in compartments where the changes could be made without causing a draught would be highly desirable. But where it is considered that under natural conditions, air cannot be changed more than three times per hour without creating a draught, together with the following table (taken from a reliable source) of the rate of increase of impurities, it will be noticed, and I think forced home to any of my hearers who may have control of such things, that air in a small space becomes impure quicker than in a large.

RATIO OF IMPURITIES FOUND IN AIR PER HOUR.

	1000 cubic feet.	500 cubic feet.
1 hour	·12 per cent.	·18 per cent.
4 ,, ...	·30 ,, ...	·54 ,,
6 ,, ...	·42 ,, ...	·78 ,,

One is apt to speculate after perusing the above. What would be in the figure for 72 cubic feet, under sea conditions where ventilation can generally be classified as non-existent.

It is obvious, therefore, that for vessels trading in cold

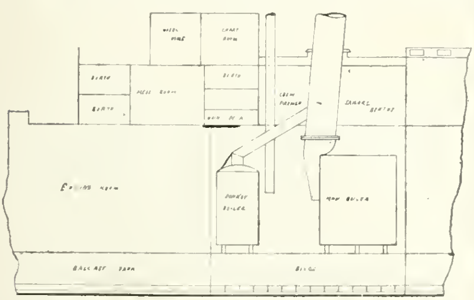


Fig. 4.

climates, some system of heating the in-coming air is necessary to enable sufficient air changes to be effected without undue draught, and adequate heating at that.

Ventilation can be classed under two broad heads, Natural and Mechanical. Of the natural system for marine purposes, the Boyle patent air pump system certainly ranks high. The essential features of this system are the air pump ventilator (uptake), consisting of an arrangement of metal plates, at certain curves and angles, enclosed in a central chamber, from which the air is exhausted through a series of openings or slots, by the deflecting of the current of external air across the opening, and so creating an induced current in the ventilator and up the shaft and a down current ventilator

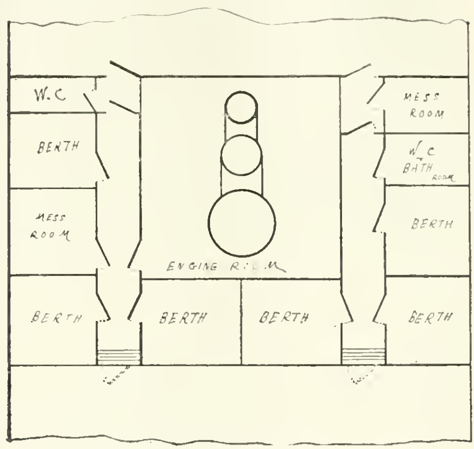


Fig 5.

of such a form, that the heads require no trimming, and a series of air shafts completes the system.

The makers claim for this system the following advantages:

1. Boyle's Patent "Air-Pump" Ventilator creates a continuous and powerful up-current when the vessel is lying in harbour or sailing. The latest patent has double the extracting power of the earlier forms, so that smaller ventilators may now be used, effecting not only a considerable reduction in the cost, but also a saving in space.
2. It is entirely free from down-draught.
3. It is perfectly water-tight, and may be kept in action during the stormiest weather.

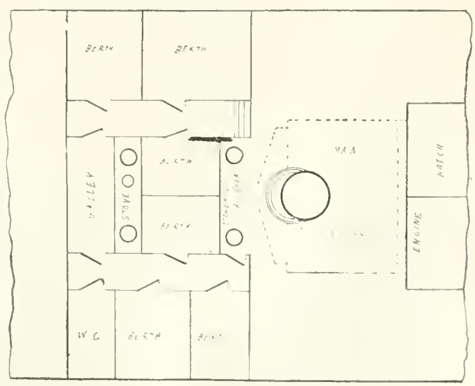


Fig 6.

4. It is a fixture and never requires trimming, acting with equal efficiency with the wind blowing upon it from any point. Having no mechanical movement it requires no attention and can never get out of order.
5. Boyle's Patent Downcast Ventilators send an abundant supply of fresh air below, and have in an equal degree advantages 3 and 4.

6. The exhaust and supply pipes may be concealed behind cornices, underneath seats, bunks, etc., and do not interfere with the structural arrangements or decorations of the saloons or state-rooms.

7. Hot water or steam pipes may be placed within the supply shafts for the purpose of warming the air in cold weather. Ice-boxes can be also fixed in the main shafts for cooling the air supply in hot weather.

8. The air is admitted into the saloons and state-rooms through small vertical tubes, so that no draught is experienced, and the supply can be regulated as desired by means of a valve fixed in each tube.

9. The warm vitiated air is exhausted at the upper parts to where it naturally ascends, and the fresh air admitted in a vertical direction at the lower parts.

10. The ventilators can be readily adapted to existing arrangements and fittings on board ship.

11. Being waterproof they are most suitable for the ventilation of ships' tunnels.

The mechanical systems can be again sub-divided into suction and propulsion. It has been said of the propulsion system that it causes stagnant places and consequently merely a matter of fresh air is concerned, ignored. Many cases are to be found where the back of the engine-room is supplied with ventilators, all too small under the best conditions, but rendered absolutely useless by two right-angled elbow bends.

The position of important ventilators on deck often sacrifices efficiency for appearance, and I am sorry to say the prevailing conditions are often intensified by the thoughtless persistence in erecting screens for a little personal comfort, smart appearance and the protection of a small portion of the snow-white deck, so dear to the heart of the chief officer. Figs. 1 and 2 illustrate the common practice of placing ventilators on deck and in the stokehold. Perhaps the most glaring case of want of thought on the part of builders is illustrated in Fig. 3, which speaks for itself.

In connection with the ventilation of an engine-room and stokehold, therefore, I would suggest the following rules :—

1. Use circular ventilating shafts instead of square, a circular section only offering seven-eighths of the resistance of a square of the same area.

2. Have shafts as short, smooth and air-tight as possible.

3. So place the up-takes and down-comers as to avoid air

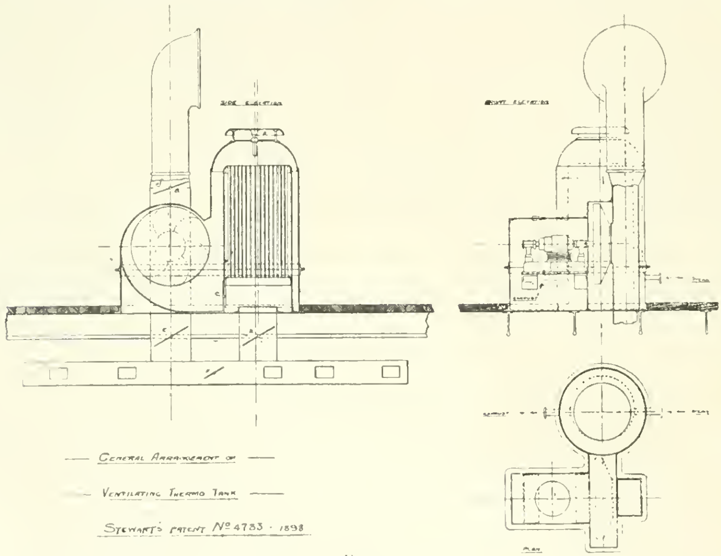


Fig 7.

results in dirt and filth heaving up in out-of-the-way corners. A combined system of extraction and propulsion would possibly better meet the requirements. Steam jets have been used for creating a draught in ventilators, but the great noise and loss of water all worked against its success.

In connection with the ventilation of the engine room and stokehold a problem presents itself. Care should be taken, when natural draughts-methods are in use, to so arrange ventilators to prevent the air merely passing down the one and up the other. I would advocate a more efficient and satisfactory system of ventilating the bilges by extending both ventilators and uptakes down through the stokehold plates, the latter carrying some convenient exhaust pipe to assist in producing an up-draught. By this means a cool current of air would continuously pass under the plates, resulting in a cooling effect in the engine room, besides greatly preventing the discharge of bilge fumes, directly into the engine room, as is at present the case.

How often do we find ventilators in the stokehold and engine-room so placed and constructed as to be useless. The fact that a right-angle bend in an air trunk reduces the delivery of air by one half seems to be unknown, or where merely passing down the one and up the other.

4. Avoid angles and bends.

5. Fit cowls to both up-takes and down-comers.

6. Arrange ventilators and exhaust steam pipes so that the otherwise waste heat of radiation will assist ventilation.

7. Do not sacrifice appearance on deck for efficiency of ventilation.

Cabins and Berthing.

The general arrangements of cabins for the passengers, and especially those of the ship's company who have to make the vessel their home, now demands attention ; by cabin I include the berths of the ship's company as well as those of the commanding officers.

Perhaps the most satisfactory position for berthing accommodation is in the alleyway, but, like everything else, it is not sufficient that a berth should be so placed ; a little thought is also required to ensure the best arrangement of berths. Such conditions as you have illustrated in Figs. 4 and 5, I am sorry to say, are not uncommon in the mercantile marine. And I say that the placing of berths adjoining engine-room, galleys or stokehold, the berthing of firemen in the fiddleys and

engineers in the engine-room, is a practice which should be abandoned as both insanitary, dangerous and intolerable.

Berths in modern ships generally consigned to those whose duties are both responsible and trying, are still constructed where the temperature and impurity of the air from moisture, engine fumes and bad ventilation are so great as to make even the necessary repose a matter of impossibility. Sleeping berths placed next to the galley, with bunks separated from the cooking stove by a thin steel bulkhead covered with thin match boarding, or what might be termed a special incubating apparatus for bugs and beetles, are also conditions which, in this 20th century, do still exist and which have to be tolerated by those who enjoy "A life on the rolling wave." See Fig. 6.

In connection with berthing in alleyways, care should be taken to ensure a through current of air at all times, and that cabin doors are as far as possible away from those of w.c., baths, engine-room and galley; parts can be then arranged opening into the alleyway with very beneficial results.

In this direction I would strongly advocate the introduction of a form of Tobin's tube as used ashore, fitted with a cotton air filter to remove any particles of dust from the entering air.

The practice of fitting sounding pipes to bilges and tanks in places used as berthing accommodation should decidedly be discontinued. Not only is there risk of contamination of the water due to animal and other impurities passing down the pipe, but badly fitting plugs, as they usually are, allow foul gases to discharge directly into small berths. Badly constructed and badly ventilated lavatories discharging impure air into blind alleyways, could be remedied. I am sure that those who are personally acquainted with the facts will agree that these conveniences at sea, especially those marked "For crew's use," are not of the best.

Paint locker and bo'sun's stoves next to forecastles and the use of the fore peak as a general store-room, with only an opening through the forecastle, covered over with a few planks, all indicate a want of thought on sanitary subjects on the part of those responsible for ships' construction. Whereas the common practice of fitting shelves and food lockers in forecastles, where one watch or the other are always sleeping, and in the case of what might be termed "weekly boats," such as provisions as meat, fish, etc., stored in the forecastle, should be at least changed.

Heating

The earliest method of heating was by stoves, and to-day in many instances this type is still in existence. My own opinion is that in many cases it is the best means of heating remote parts of the ship, but not the usual type as usually seen. A proper ventilating stove would solve many problems, but to allow the use of an ordinary cast-iron stove with a funnel passing through the ventilator, stopping ventilation and pouring poisonous carbon monoxide into the air, to say nothing of organic particles in the air giving rise to a sickly odour, is a condition which cannot be too strongly condemned.

Steam heating is handy and, if combined with ventilation, is satisfactory. Dr. Reed, M.D., says the following about steam heating:—

"No system of warming by hot pipes is advisable unless both inlet and outlets are provided for ventilation," and from this it is obvious the practice of introducing a series of steam coils or pipes only is harmful and objectionable, only less so than unhealthy oil stoves, heated bricks, or drums of hot water frequently changed.

The coils are usually placed in out of the way corners, they collect dirt and filth, which is duly baked and dispersed in fine powder to be breathed by the inmate, or where a pipe is led along the floor of a cabin, collecting around it all the debris. Leakage of joints makes the berths damp and the noise caused by water hammer action, the minor trouble, is certainly undesirable and frequently extremely objectionable.

In connection with heating and ventilation system the patent Ventilating Thermo Tank is good and is shown in Fig. 7.

The system consists of a cylindrical tank fitted with tubes from end to end, the whole being enclosed in an outer casing connected with which is the discharge fan.

The heating medium (steam) circulates in the cylinder (round the tubes), while the air to be heated passes through the tubes, as shown in the illustration.

The system can be admirably adapted for cooling the entering air (for vessels trading in the tropics) by connecting the Thermo Tank to the refrigerating brine circuit, or

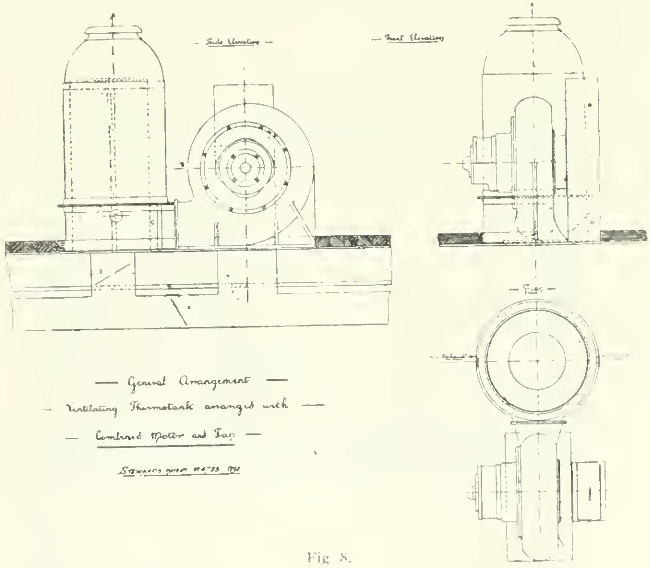


Fig. 8.

connecting the tank to the refrigerator, upon the expansion system.

The makers kindly furnish the following description of the apparatus :—

In order to show the working of the Thermo Tank for supplying, circulating, or exhausting air, different valves have been arranged and lettered A, B, C, D, E, F, respectively, on the sketch, and the mode of operation is as follows :

1. Heating and cooling fresh air supply. Valves A, C and C are closed. The air then enters by the valve B and is driven by the fan through the tubes in the Thermo Tank (which is either heated or cooled as the case may be), into the trunks through the valve D. It is then distributed to the compartments by the louvres in the usual way.

2. Exhausting foul air. Valves B, C and D are closed. The air is then drawn by the fan from the trunks through the valves E and F, and there discharges to the atmosphere through the valve A.

3. Fresh supply of air at atmosphereic temperature. Valves A and E are closed, the air is then driven by the fan through the valves B, C and D into the trunks, and also to the compartments.

4. Circulating air through the compartments. Valves Al, B, C and F are closed. The air is then drawn through the valve E from one section of the trunks, and is then driven through the tubes to the other section of the trunks through the valve D, thus maintaining a continuous circulation and heating the compartment very rapidly.

It is not sufficient that apparatus are made and placed on the market claiming sanitary advantages to justify their use. An investigation of the many discarded apparatus ashore since sanitation and sanitary experts have come prominently into existence will justify this remark. In fact, a close study of the various methods would be a material help in solving the complications that a modern steamship offers.

The problem presents difficulties which can be only solved by combining a knowledge of practical sanitary science with an intimate acquaintance wth marine conditions in all their phases.

That improvements can be effected in even existing vessels is apparent, and that in many cases where owners have fitted special appliances at considerable expense, these appliances more often than not prove not only useless, but an encumbrance is too truly a fact. The introduction of forced draught, liquid fuel and turbine arrangement, while offering advantages and being a step in advance, make it more than ever necessary to study ventilation for humanitarian reasons. It is not sufficient to indiscriminately sleuch around fluid from a drum labelled "Disinfectant," and to imagine that that and the sea air will do the all in all required.

Upon the subject of disinfectants I repeat an extract from my previous lecture as possibly being acceptable information.

The term disinfectant should be only applied to those substances which are absolutely destructive to disease germs; many so-called disinfectants are merely antiseptics, that is, they prevent disease germs from developing, but in the strength used on board ship, even the best can be ranked as merely deodorants and of practically little or no use.

Dr. Reid says, "The essential condition of a true disinfectant is that it shall be capable of killing germs and their spores, it shall be applied to every part, in sufficient strength for a sufficient time."

Taking two of the best, namely, bichlorate of mercury and carbolic acid, we find that to be effective a solution of 1 in 1000 in the first, and 5 in 100 in the latter is required. Below this it degenerates into an antiseptic, and as practised in the engine room on board ship it is merely so. It would require a veritable cargo of carbolic acid to effectually disinfect the engine room bilges on an ordinary short voyage. It is obvious that sanitation does not wholly lie in disinfecting fluids.

It has always been a matter of surprise to me that such poor attempts have been made when designing a ship, at ventilation and ship sanitation in general. Confining myself to the section laid down, namely, ventilation, heating, berthing of ships. I would suggest that owners, builders, superintendents and the ship's crew in general could do much to improve the conditions, for it can be laid down as a maxim "A healthy ship is a wealthy ship."

To the owner I would say, do not grudge such space and conditions for your ship's company as will make their forced home afloat livable in all climates.

To the builder. Consider the sanitary side of marine engineering and naval architecture. You have hot pipes which could be aptly used for desirable ventilating system in conjunction with trunks, such as tunnels, casing, masts, derricks. Remember human beings have to spend those valuable years of their life in the confines you fashion.

And for all those who go down to the sea in ships.

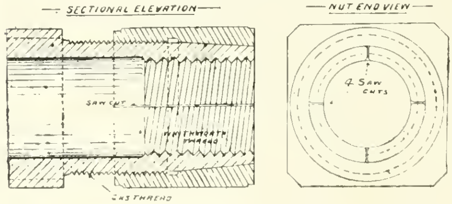
Remember each other and for a little personal comfort or possible inconvenience do not inflict such a condition on others as makes life burdensome and unhealthy; adequate light, heat and air are reasonable conditions and go a long way to help an efficient service from all hands.

ANDERSON'S STUD EXTRACTOR.

We have pleasure in drawing the attention of our readers to an ingenious stud extractor which has just been introduced by Mr. Peter Anderson, of 18, Collingwood Road, West Hartlepool.

These stud extractors are designed to meet a want which is of everyday occurrence in an engineering establishment, *i.e.*, a suitable tool for the withdrawal of a stud which has been found too tight for the hole into which it was being screwed.

As will be seen from the illustration, which is a section through the extractor, the tool consists of two



parts. There is a sleeve part having a square at the top to take the checking spanner, a body on which a fine gas thread is cut, and a tapered end as shown.

There are four saw-cuts in the sleeve to allow it to contract and grip the stud. One of these is shown in the section and the four in the end view.

The internal part of the sleeve is screwed for about half its length to take the size of stud it is required to extract, and the remaining portion is screwed a little larger than the thread for clearance.

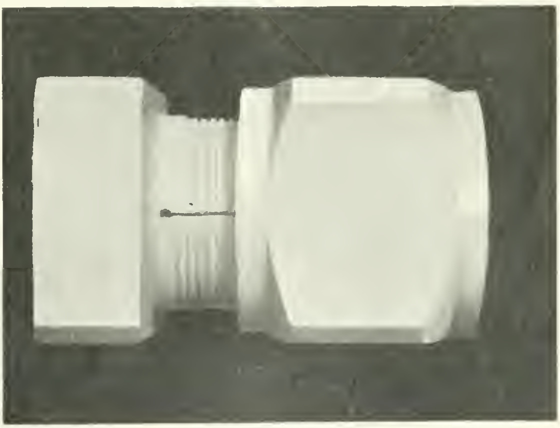
The other part of the extractor is a special nut, which is screwed with a gas thread for about half the depth of the nut, and the other half of the nut is bored taper to suit the sleeve.

The method of extracting a stud is as follows :— Keep the nut easy on the cone and run the extractor on to the stud till within about three threads from the shoulder. The top end of the sleeve piece must now be checked with a spanner on the square provided, whilst the pressure is being put upon the nut. Continue putting pressure on nut till stud begins to move out, then remove checking spanner and continue to unscrew till stud is extracted.

These extractors are at present in daily use in one of the largest engineering establishments on the North-East coast, and are giving every satisfaction, especially in dealing with propellor boss studs. With the extractor it is possible to extract these large studs in very much less time than was occupied in the old-fashioned method, and there is no possibility of damage to the threads.

The extractors are substantially made in cast steel, and can be had suitable for studs from ½ in. up to 3½ in. diameter. They are finished bright all over, and have a neat appearance.

These tools are most useful on repair work, where steam and water joints have been eaten away, requiring the faces to be re-machined, the stud extractors removing the studs and replacing them after the machining has been completed.



Anderson's Stud Extractor

THE RUBBER COMPANY OF SCOTLAND, LTD.

A FEW minutes' ride by car from Stirling towards Bridge of Allan brings one to the extensive Forthvale Works of the Rubber Company of Scotland, Ltd., covering a large extent of ground alongside the river Forth. Situated amid an area of historic interest, and within a short range of scenes of beauty and delight, it is difficult for the casual visitor to bring his mind to realize that here commerce and trade hold mart—that, indeed, but a step separates the romance of the past from the reality of the present. The magnificent expanse from the monument on the Abbey Craig, with the mountains and glens, sites of ancient battles, the windings of the Forth, and the old Abbey amid the ruins of which rest the dust of kings; each and all appeal to the imagination to weave into word pictures, incidents and peoples of times long gone by. We awake to find ourselves in more prosaic surroundings and amid displays the like of which go towards maintaining the national wealth and industry. The manufacture of goods into which rubber enters is carried on here, where the healthy atmosphere of the country pervades the works, giving to the workers energy and zest for their daily toil, if toil it can be called under such auspices. The crude material requires no special comment; it is chiefly obtained from Para and the West Coast of Africa. The dough is kneaded by the usual mechanical appliances, and rolled out under pressure to qualify it for the various purposes to which it is applied. The weaving of the sheeting of various textures, and the spinning or rolling from asbestos or canvas, according to requirements, into packing of sizes and sections of different styles, are operations of considerable interest to the engineer who has to deal with the finished article. Tape for joints, either in rolls or made up into shapes to suit boiler doors, are seen in all stages of manufacture. Valves for pumps moulded or cut from sheets in many different sizes, and for acting in different liquids the composition being made to give the best results, whether to resist the action of oil, hot or cold water, or acids of various sorts. Rings of round, square or other section invite inspection, and the deftness of hand shown by the young ladies occupied in finishing these articles compel our admiration. A small ring mounted on a tripod calls for comment and question, and we find it is a soap-saving appliance which is neat, and allows the wet soap laid aside to rest on the ring to dry in place of melting itself away as in the ordinary soap dish. It is neat and cleanly. Another article for domestic use has here to be explained, as its utility is not obvious; it is a rubber buffer to keep in order the window which, amid the stormy blasts of winter, has its nerves unstrung, whereat it shakes and trembles, disturbing the peace of the household. Waterproofs of many sorts and sizes, aprons and such like protections from the rain, snow or the dust stirred into action by the modern vehicle. Next we see tyres for wheels, a portion of the industry which has demanded the use of so much rubber that prices have materially affected both the cost and the quality of many of our articles in common use both at sea and on land—no doubt it has also had the effect of stimulating the inventive faculty with a view to utilize and make effective other materials to obtain equal or better results. Wringing machines now meet our eye; these are fitted with rubber rollers, and meet with acceptance by the housewives who have tried them. A large department is devoted to the manufacture of all sorts of India rubber hose pipes and tubing.

A speciality of this Company are mats and mattings in a great variety of designs for ships, carriages, motor cars, etc., and rubber goods for railway companies, such as buffers, pads, springs, vacuum and Westinghouse brake pipes, hose pipes and diaphragms are largely manufactured.

A novelty this Company have recently put on the market is an asbestos hot bag for warming purposes, which is meant

to take the place of India-rubber hot-water bottles, and consists of a bag made of specially woven asbestos cloth, containing material which absorbs heat and retains it for a considerable period. Hot water is not required, and the bag is simply heated in an oven or on a hot plate, and afterwards slipped into a flannel cover. The cost is much less than for ordinary India-rubber hot-water bottles, the Company being prepared to send sample bags to any address in the United Kingdom for 2s. 6d. each delivered free.

The Company was formed in 1897, when about 5½ acres of ground was taken on the North Bank of the Forth, including premises formerly occupied by a wool spinning factory. Having free water rights and a property acquired upon exceptionally favourable terms, these works are happily situated commercially, in that the capital expended initially being comparatively small, the essentials of up-to-date machinery and appliances can be made a prominent feature and articles of manufacture produced under circumstances favourable alike to the producer and consumer. The company is included in the Admiralty list, and their customers include railways, factories, steam ships and engineers, both land and marine.

ELECTRICITY ON BOARD SHIP.

XIII.*

By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc.M.I.C.E., Etc.

The Main Switch-Boards of the Ocean Liners.

THE main switch-board fixed on board the White Star steamship *Adriatic*, by Messrs. W. H. Allen & Sons, and the switch-board fixed in the steamship *Baltic* are very similar. The arrangement is as follows:—There are four generators in the *Baltic*, five in the *Adriatic*, each of 100 kilowatts, furnishing current at 102 volts, which gives the current at 1,000 ampères each. The machines are driven by directly connected unenclosed compound engines, their axles being fore and aft so that the armatures and cranks revolve athwartships. The main switch-board is of enamelled slate, and occupies nearly the whole of one end of the electrical engine house and is divided into three in the *Baltic*, and five in the *Adriatic*. The centre panel in the *Baltic*, and the three centre panels in the *Adriatic* are for the generators, and the panels on the two sides are for the lighting and the power and heating circuits. The generators are worked in parallel the large switches in the panels in the centre being for connecting the different dynamos to the bus bars.

In the steamship *Lusitania* there are four dynamos each capable of furnishing 115 volts and 3250 ampères, the dynamos being directly connected to steam turbines the speed being 1200 revolutions per minute. The arrangement is a little different from that of the White Star liners, the engine house being divided by the fore and aft water-tight bulkhead, there being one of the automatically closing doors between the two divisions, and two turbo-generators being in each division. The switch-board is divided into two, half in each division and there is a small controlling switch board, arranged so that if the engineer is left in either division of the engine room by the closing of the water-tight door he can control the dynamos in the other division from the one he is in. The dynamos run in parallel similar to those of the steamships *Adriatic* and *Baltic*, and the arrangements for connecting the dynamos to the bus bars, are on two smaller switchboards, by the side of the feeder switch boards, one in each division of the engine room. The steamship *Lusitania* has one other feature that so far has not been much applied in board ship work, *viz.* the automatic cut out. The apparatus will be fully described later on. It is almost universally employed in generating stations on shore. In the steamship *Lusitania* the automatic cut-outs or circuit breakers, as they are more frequently called, have also a further novelty in board ship work the time limit arrangement. The automatic cut out, or circuit breaker, is designed to break the circuit of any cable or pair of cables in which a dangerously heating current is passing, and to do so more quickly and efficiently than the fuse that will also be described later and that are also universally employed, are able to do. Fuses, which depend for their action upon the melting of small quantities of metal inserted in the circuit, take a certain time to "blow," and are somewhat uncertain in their action. Circuit breakers are certain, but they are sometimes too quick, and for this reason a supplementary device has been introduced into many generating stations on shore, in which the circuit breaker does not operate until the "short circuit," or the dangerously heating current, has been passing for a certain number of seconds. On board the steamship *Lusitania* time limit circuit breakers are fixed to protect the turbo-generators.

* For Articles I. to XII. see last twelve issues.

The Size of Cables for Distributing Current.

In the early days of the use of electricity on board ship it was hardly necessary to consider the size of cables very seriously. The important point was to render them strong enough to stand the vibration of the ship, and to protect their insulating envelope from mechanical injury and from wet, etc. With the increased use of electricity on board ship, however, and more, with the increased size of ships, the size of cables to deliver the current has become a most important factor. The current, for instance, taken by the great liners runs into thousands of ampères, while the pressure at which the currents are generated is at present much lower for the power than is usually employed on shore, so that the cables in these ships bulk largely in the very fullest sense of the term. The writer understands that the main distributing cables of the steamship *Lusitania* consist of 193 No. 13 wires, the branch cables being proportionately smaller, but still of large section. On shore-cables of that size are absolutely exceptional. The engineer who had to lay out a distributing plant for supplying light and power for a town, would never dream of going to anything approaching the size of the cables mentioned. Immediately his cables begin to range above such sizes as 37 No. 16 wires, or thereabouts, he would begin to reduce the size of the cables by increasing the pressure, and so on.

The sizes of cables for any purpose are ruled by two quantities, the strength of the current the cable has to transmit, and the loss of pressure that may be allowed between its two ends. As already explained, every cable or pair of cables makes a charge upon the initial pressure delivered by the generators for the passage of the current through it or them, the charge being measured by the formula,

$$E = CR,$$

where E is the number of volts used up, or absorbed by the cable, C is the strength of the current passing through the cable in ampères, and R is the resistance of the cable in ohms. The resistance of cables varies directly as their length, and inversely as their cross section. In other words, the larger the cables the lower the resistance for a given length. To take an illustration, the resistance of the cable mentioned, 193 No. 13 wires, is approximately ·002 ohm per 100 yards, so that a pair of distributing cables of this size, each 100 yards in length, would have a combined resistance of ·004 ohm. The ohm, it will be remembered, is the unit of electrical resistance. Assuming that the pair of distributing cables in question were required to carry a current of 500 ampères, the formula above works out as follows:—

$$E = 500 \times \cdot 004 = 2 \text{ volts.}$$

That is to say, the pressure at the end of this pair of cables would be 2 volts less than at the commencement, say at the main switch board and if the cables were made to carry, say, double the current, or 1000 ampères, the difference in pressure, or the fall in pressure, as it is usually expressed, between the main switch board and the distributing point at the end of this pair of cables would be 4 volts.

The fall in pressure that can be allowed varies according to the work for which the current is to be used. Where it is employed for furnishing incandescent electric lamps, as a very large portion of the current generated in the large steamships mentioned would be, only a very small difference of pressure is permissible between the main switch-board and the terminals of the lamp using the current. And the reason for this is as follows: With incandescent electric lamps made to work with pressure of 100 volts, a good light is obtained with from 100 volts down to 98 volts at the lamp terminals and a fairly good light especially in confined spaces, with as low a pressure as 95 volts. If it is arranged

that all the lamps supplied from a particular pair of distributing cables are worked with, say, 98 volts pressure at their terminals, and if a large number of the lamps supplied by that pair of cables are extinguished during any portion of the twenty-four hours, the pressure at the terminals of the remainder will go up, more or less seriously, according to the size of the cables, and the pressure absorbed in them. Taking the case mentioned, of the *Lusitania*, and assuming that one pair of cables is furnishing 500 ampères for certain lamps, which means a little over 800 lamps of 16-candle power, and allowing for a further loss of, say, 4 volts between the distributing point at the end of the cables and the terminals of the lamps, making a total fall of 6 volts between the main switch-board and the lamps, it will be necessary that the pressure at the switch-board shall be 104 volts, if that at the lamps is to be 98 volts. Now suppose that two-thirds of the lamps are extinguished. This means that the loss of pressure is now only 2 volts between the main switch board and the terminals of the lamps that are still burning, and the pressure at these lamps will rise to 102 volts, with the result that they will be very much brighter than is usually necessary with lamps that are left burning at such times, and in addition, their filaments will be very seriously strained, their life will be considerably reduced, and the familiar blackening of the bulbs, which is such a serious matter in connection with incandescent lamps, will commence very early. The treatment of the question will vary with different cases. Thus, it may be possible to arrange that all lamps that remain burning during hours of light load, are on one set of distributing cables, but usually this is not easy to accomplish, especially in such a case as the great ocean steamers, because amongst other things it is necessary to arrange that in the event of the failure of any particular pair of cables, the whole of the lamps in any department, say, in a saloon, or in a smoke-room, shall not be extinguished. The writer will go more fully into the matter in the next article.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

Electricity on Board Ship.

THE maiden voyage of the *Lusitania* calls to mind the position taken up by electricians in connection with marine work in the present day, not only in first-class liners, but also in naval work. What with electric elevators between decks, submarine signalling installed and wireless telegraphy, the developments that have been made are of the most interesting character. In addition electricity is applied to steering, the control of bulkhead doors, the working of deck winches, as well as heating, lighting and cooking, which are all operated by the same means. The extended use of electricity causes the question to arise of the risks involved from fire due to defective insulation. This on board ship is more likely to occur than on land, due to the effect of salt water and air. If also wires are not properly protected, there is a risk from slight collisions or even the force of the sea causing a short circuit. The dynamo room has also to be specially protected and be as far as possible from the coal bunkers and cargo spaces, so that any escaping gases have a long distance to traverse to the electrical machinery. The wires on board ship have to be more flexible than on land, from the fact that the vessel is always a moving platform and a lead covering is usually employed where the strain is greatest to prevent disruption of the insulation. As long as this may be prevented safety follows.

Shipbuilding Cableways.

A paper has recently been read on the cableways installed at Palmer's works at Jarrow, which shows that some slight improvements have been made in the conductors for supplying energy to the load carriage motor controlling the end carriages. The original collectors were of the sliding type, but this has been improved upon by providing a bogie carriage to run on the upper surface of the wires, with separate flexible cables leading to the load carriage. The new arrangement is said to have proved most effective.

Electric Wharf Cranes.

We referred recently to the system employed by Messrs. Stothert & Pitt, of Bath, of a free barrel in their type of crane, and this firm has recently despatched several cranes built in this manner to Rio de Janeiro. Five are of the portable type, mounted on trucks, and the lifting, slewing and travelling motions are by separate electric motor. The lifting is arranged on the free barrel system, the rope barrel running loose on the shaft and being connected or disconnected by a coil clutch. The advantage given by the free barrel is that the load can be lifted to any desired height and released under the control of a foot brake, the motor thus not being subject to any sudden shocks. The system ensures that by one movement the current is given to the motor and also engagement made with the coil clutch. It is impossible also to work the brake against the controller handle. The weight of the superstructure is taken on a train of turned steel rollers. The travelling motor is fixed on the centre sill of the truck and one travelling wheel at each side of the crane is driven by it through gearing. The corners of the truck can be screwed down to effect a hold in any position. The motors are series-wound of the enclosed type, each controlled by a controller of the metallic type. Energy is supplied by flexible leads from junction boxes to a plug box on one leg of the crane and conveyed to the switch board by means of ring collectors on the centre pin. Incandescent lights are fitted in the house, also a cluster under the jib for night work. The maximum load of these cranes is 5,000 k.g. working at a radius of 14 m., the height of the centre of the jib head pulley being 18 m. from the rail level at this radius.

Wireless Telegraphy.

The Admiralty is instituting a special branch of the service for this department apart from the ordinary signalling. This is evidently a recognition of the importance that this department will take in the future in the fleet and the arrangement will come into operation at once. The report of the radio telegraphic convention select committee appointed by the Government to consider what took place at Berlin from the point of view of the national interest therein is published. We gather from this report a history of the subject brought up-to-date. Depending on the power the range is given as 1500 miles at a maximum, and it is not decided that direction is yet fully possible by any system. The report then goes on to give the uses to which this form of telegraphy may be put, but here we are all on familiar ground. It is given out that in the present position there is no likelihood of the system supplanting cables or overland wires. We may take it that the rapid progress made rendered the international convention necessary and this is the conclusion of the committee so far as it has been given.

Mr. H. Bertram.—On the occasion of his appointment to undertake some special work in Brazil, on behalf of a well-known firm of contractors, Mr. H. Bertram (hon. minute secretary, Institute of Marine Engineers) and Mrs. Bertram were the guests at a very pleasant gathering in the Alexandra Hotel, Stratford, on August 12th. After dinner and a few introductory remarks by the Hon. Secretary of the Institute, who presided, a gold pencil case was presented by Mr. A. E. Battle to Mr. Bertram as a souvenir from the friends present, of their appreciation of the agreeable intercourse they had experienced while their guests had been amongst them. In making the presentation Mr. Battle commented on the great help Mr. Bertram had been in connection with the Institute of Marine Engineers. The warmest wishes of all would follow him to Brazil, and their hopes were to see him back once more ready to resume his old associations. The remainder of the evening was spent in the harmony of music and song, varied by several excellent recitations, of which Mr. Bertram contributed two. The company broke up after singing Auld Lang Syne and wishing Mr. Bertram good speed on his voyage.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

New Shipbuilding Contracts.—While the highly important order, rumoured as having been secured by an upper reach yard, for a battleship for Japan and two high-class ocean liners, to which guarded reference was made in last month's notes, has so far apparently been premature, there has nevertheless been a gratifying number of orders placed since the penning of last month's notes. The Peninsular and Oriental Company have placed an order with Messrs. Caird and Company, Greenock, for another steamer of 11,000 tons, similar to the two ordered some time before and referred to last month. The new steamer will be the eighth of the *Moldavia* class, and will have propelling power equal to the maintenance of a speed of 18 knots. The Company, it may be stated, have thus, in consequence of the obligations entailed by the new mail contract, begun the construction of four steamers aggregating 40,000 tons, the cost of which will largely exceed one million sterling. Messrs. William Denny and Brothers, Dumbarton, have secured contracts for two of the twelve coastal torpedo boat destroyers recently given out by the Admiralty. The fact that the renowned Dumbarton firm have got this second order even before the first of last year's contract has been tried, is proof of Admiralty satisfaction with the way the firm have tackled the problems of design and construction. Messrs. David and William Henderson & Company, Ltd., Partick, have received an order from the Anchor Line for a large passenger and cargo steamer for that Company's Indian service. The vessel will be practically a duplicate of the *Castalia*, lately built by Messrs. Barclay, Curle & Company, Whiteinch, and besides having capacity for a large cargo will have accommodation for about 100 cabin passengers on the bridge and promenade decks. The Greenock and Grangemouth Dockyard Company, Ltd., have obtained an order for a large and powerful steel screw tug for the Montreal Transportation Company, Ltd., Montreal, Canada. Mr. A. M. Gordon, naval architect, Glasgow, has contracted on behalf of the Egyptian Government with Messrs. S. E. Saunders and Company, Cowes, Isle of Wight, to build two patrol motor launches to be fitted with "Gardner" paraffin engines. They will be of similar design to the two launches recently shipped from the Clyde for the same service.

New Clyde Trust Repair Works.—The new works which the Clyde Trustees are laying down at the mouth of the Pudzeoch, Renfrew, for the repair of the dredgers, barges and other plant owned by them—which are to take the place of the works at Dalmuir, further down the Clyde, the site of which has been sold to and will in a short time form part of the extensive naval works of Messrs. William Beardmore and Company—are fast approaching completion. The new works are laid out on an area of about nine acres, most of which had to be raised about 6 ft. mostly from the excavations taken along the river frontage, thus widening the river here by about 80 ft. The river frontage is about 736 ft. in length and part of it consists of a wharf on which a 25-ton crane will be erected. There will be another wharf on the west side of the works, and the old harbour of Renfrew will be increased in area from two to four acres so as to provide for all the plant which will require accommodation at the works. A large hauling up slip for hopper barges, and two smaller slips—one for steam ferries and another for punts—are being constructed. The main shops are contained in two blocks of buildings, one of which, 340 ft. by 140 ft., comprises the engine shops, general stores, boiler shop, and smith's shop, and the other, 150 ft. by 120 ft., the saw mill, joiner's shop, pattern maker's, carpenter's and boat builder's shops.

Work in East Coast Yards.—The shipbuilding industry in the Dundee district is at present very brisk, Messrs. The Caledon Company and Gourlay Bros. & Company having well filled stock. Amongst the latter Company's orders are two vessels for Austrian owners, whose propulsive machinery will consist of triple screw engines of the enclosed fixed lubrication type, which is a speciality of the builders. The position of ship surveyor to Lloyd's at Dundee is being taken up by Mr. Matthew Blackwood, who has been for 6½ years a surveyor on the staff of Lloyd's Register in Glasgow. The Harbour Trustees of Montrose have decided in favour of granting a shipbuilding firm a site on their grounds for drifter building purposes. The Works Committee of the Aberdeen Harbour Board have accepted the tender—the lowest received—of Messrs. Vickers, Sons & Maxim, Ltd., Barrow-in-Furness, for the construction of a new off-shore steel floating dock for the Albert Basin at Aberdeen. Messrs. Scott, Ltd., of Kinghorn, have commenced the construction of a first-class twin-screw passenger and cargo steamer to the order of a Singapore firm. The vessel, which will be of 700 tons register, will, on a light draught, carry a large number of passengers at a high rate of speed. The Kinghorn firm are also at work on a steamer for South Australian ownership. Messrs. Mackay Brothers, Alloa, on the Firth, have recently launched the last of the three cargo and passenger steamers which they had on order from the Lloyd Brazileiro, Rio de Janeiro. The vessel has been specially designed to carry a large deadweight on a shallow draught, and will be fitted with twin-screw engines by Messrs. Aitchison, Blair & Company, Clydebank.

Models for Experimental Work.—Messrs. Kelso and Company, the well-known makers of models and model fittings—especially as regards ships, shipyards and docks—have just completed in their new premises at 1008, Pollokshaws Road, a most interesting and beautiful model of a submarine boat, whose function is torpedo discharging, which has been prepared to the order of Messrs. Mees, Denham & Company, Glasgow, for a firm of shipbuilders in the Netherlands, who, as builders of the actual submarine in question about two years ago, and in which the Dutch Government was interested, are to present the exquisitely finished model—a veritable submarine in miniature—to Her Majesty the Queen of the Netherlands, when she visits the builder's yard about the middle of this month. Messrs. Kelso & Company, it is of interest to add, are about to despatch to the Mitsu Bishu Company, Nagasaki, Japan, the whole plant and very special accessories (in the making of which they have unrivalled experience) appertaining to the experimental tank for ship models which they have been for some time engaged upon. They supplied, it may be remembered, the whole of the special apparatus for the tank at Spezzia, the tank at St. Petersburg, and the later and up-to-date experimental department at Clydebank, when the results obtained and deduced from trials with models so much helped the Clydebank designers to attain the success of the great Cunarder, *Lusitania*. Other work in hand in the splendidly-equipped new premises of the Kelso firm consists of full models, with cases, for a number of Glasgow and Greenock shipbuilders and ship-owners, and a somewhat special item in the shape of a "bird's-eye" model entirely to scale of the new Yarrow works now nearing completion at Scotstown on the Clyde. The latter works, by the way, will not be in full operation so soon as has been stated in some quarters. The whole establishment is being laid down on the principle of making gradual and full use of the already well proved modern plant at Poplar.

Exhibition Honours for Clyde Builders.—Messrs. William Simons & Company, Ltd., Renfrew, have been awarded the Grand Prix at the Bordeaux International Exhibition for their exhibits of dredging plant and elevating deck steamers. Messrs. the London and Glasgow Shipbuilding Company, Govan, and Messrs. Alex. Stephen & Sons, Linthouse, have been awarded similar honours.

THE TYNE.

(From our Own Correspondent.)

Unrest among Shipbuilding Operatives.—It appears that the rank and file of the Boilermakers' and Ironshipbuilders' Society, have declined by a vote in the branches to ratify the agreement entered into by their officials and the representatives of the employers at a conference held a month ago, whilst lock-out notices were still pending. The members of the above society have been used to having pretty much

their own way, and the idea of relinquishing this cherished privilege is not palatable. Yet, they will have to submit to the inevitable and become amenable to the discipline which is essential to the successful carrying on of any industry. It is intolerable that they should be permitted to cause a stoppage of work at any moment about some petty matter of detail, and it is equally objectionable that they should be allowed to put impediments in the way of the introduction of machinery by the use of which work may be done more economically and effectively than by hand. They also must be made to understand that the employer who provides the work and pays the wages, has the right to decide who shall do the former and receive the latter, independently of any considerations of trade union membership. Until the masters have perfectly untrammelled freedom of action in carrying on their business, they cannot be sure of maintaining the lead which they now hold over foreign rivals, who are not in any way hampered by trade union regulations, and it is on this, as well as on other accounts, imperative that the masters' right of unquestioned control should be asserted and upheld. In rejecting the agreement the members of the Boilermakers' Society repudiate the leadership of their own elected leaders and become in effect a disorganized rabble. Another conference between the representatives of both sides is now talked of; but it is doubtful whether the masters will agree to this; for who can tell whether the men will concur in any settlement which their representatives may make with the masters? And while such uncertainty prevails, what is the use of conferences? The masters cannot settle with a crowd, and how can they negotiate anything with any prospect of success, unless the representatives they have to meet are invested with authority and can control their followers? The situation as it now stands is decidedly worse than it was a month ago, and may possibly result in the employers deciding to discontinue negotiations with the Boilermakers' Society, and resolving not to be hindered by trade union interference from carrying on the business of their yards in such ways as seem best to them.

The Cunard Liner "Mauretania."—It is announced that this great vessel is to be released from her moorings beside the builders' yard and towed down the river to the sea, when after the adjustment of compasses, a preliminary trial run will be made. The two subsequent days will be occupied by speed trials between Flamborough Head and the northern coast of Scotland. After the conclusion of the trials the vessel will again be placed beside the builders' yard at Wallsend to have her final equipment completed. It is expected that she will be ready for her official trials early in October. At the firm's Low Walker and also at their Wallsend yards, there are still some berths vacant; but it is stated that new orders have been booked lately and there is consequently a prospect that the unoccupied berths will soon be filled.

Work Prospects in Tyne Shipyards.—In their monthly report for September, the Tyne district officials of the Boilermakers' Society say that they are unable to discover any improvement in trade so far as the Tyne yards are concerned; but they add that a large order which will provide work for a long time has been booked by the Elswick firm (Messrs. Armstrong Whitworth & Co.) and that the Anglo-American Oil Company are in the market for two steamers of exceptionally large dimensions. The number of members "on the funds" of the Society is given as 7,564, which is nearly 600 more than were receiving benefit in August. The Iron founders' report for September, also shows a considerable increase in the numbers of members in receipt of "donation" benefit and also a substantial decrease in the number of places described "in full work." The Palmer's Company have just launched a fine vessel for the Prince Line and have booked some orders from the Admiralty which will help materially to keep the yard in a fair condition of briskness during the remaining months of the year. The accommodation of Messrs. Stephenson's large graving dock continues to be in good demand, the vessels occupying it being usually of the very largest class. Messrs. Leslie's dock has also been pretty constantly engaged for some time past, and the same remark applies to the Wallsend Slipway Company's dock. The Smiths Dock Co. have in their various docks and pontoons a number of vessels under repair, and most of the other ship repairing firms have contracts in hand.

State of Work in the Engine Shops.—At the Elswick Ordnance and Engineering Works business is moderately good, but the staff of hands employed is below the average. The Company have just contracted to supply to the Swansea Harbour Trust a 70-ton crane for the equipment of the new King's Dock. At the St. Peter's Engine Works, more activity is noticeable than lately existed, and Messrs. Parsons' turbine works at Walker Gate and Wallsend are well supplied with orders. Messrs. Donkin's works at the former place still maintain a fair appearance of briskness, although new orders for their specialities (steering engines, ships' telegraphs, etc.) are difficult to secure. Messrs. H. Watson & Sons' various departments are keeping fairly busy, especially those shops in which the firm's well-known specialities in steamship auxiliary machinery are manufactured. Messrs. Clark, Chapman & Co. are keeping fairly busy, notwithstanding the manifest falling off in shipbuilding, and have just supplied their windlass, capstan and lifeboats to the Canadian steamer recently launched by Messrs. A. McMillan & Sons. It is understood that the electrical works of Messrs. E. Scott and Mountain, Ltd., continue to be kept actively going on colliery, pumping and ventilating equipments in various parts of the country. Messrs. John Abbot & Co. are just now busy in constructional work, and have several good contracts in hand. Messrs. Noble & Lund, machine tool makers, Felling, are very actively employed, the demand for their iron and steel cutting band saws and other specialities having very largely increased within the past year or two.

THE WEAR.

(From our Own Correspondent.)

The Local Shipbuilding Outlook.—The "slump" in local shipbuilding which we have long foreseen as likely to be brought about before the end of the year, is now so pronounced as to cause very general anxiety as regards work prospects in the coming winter. It has come as a shock to the population on Wearside, the announcement—made a few days ago—that Messrs. Doxford have dispensed with the services of a number of their draughtsmen, and that the firm have also reduced the staffs in most of the other departments. The impression existed that this firm, at all events, would be able to keep their works going full, whatever might happen in other cases, and it is now recognised that the slackness must be grave indeed, which so seriously affects the operations of an organization like this, which has the very latest means of economical production at its command. There are several other yards on the river that are reduced to a state of almost absolute idleness, and only one establishment—the North Sands Yard which still maintains an appearance of undiminished briskness. This is not the first time within the past quarter of a century that the last named yard has kept busy when most other shipbuilding concerns were destitute of work, and we have the conviction that even when the very worst of the "slump" is reached, this establishment will still have a fair amount of work in its berths. It would be well if there were a glut of repair work to make up for the depletion of new work on the river; but this is not the case, though it is tolerably certain that repair work will be more in evidence as the winter approaches.

Engineering Work.—We note that one or two engineering establishments in the district are finding for themselves a solution of the much-discussed unemployment question, by dividing what work there is among their regular hands. That is to say, they are adopting, so far as is practicable, a system by which the whole of the men are enabled to work half-time—each of two divisions working a week and "laying off" a week alternately. This seems to us a much more humane and sensible plan than that of discharging men wholesale, and if generally adopted would do much to abate the poverty that always exists in times of depressed trade. Strange to say, the most bitter opponents to this system are to be found among the men themselves, who, if they have some standing in the works where they happen to be employed, are by no means willing to share their chances with their less fortunate brethren. All honour to the firms, however, who are trying to establish this just system of dividing work, which constitutes in itself a new bond of good feeling between employers and employed.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

Lusitania.—The greatest possible interest was taken in Manchester as well as in Liverpool and New York in the recent maiden voyage of the *Lusitania*. We remember nothing like it since the days of the *Great Eastern*. One great result will be to spread the use of the turbine. This form of power is being utilized in coal mines and rolling mills for iron and steel. Cotton mills may ere long be included in the category.

The Manchester Liners have had a fairly prosperous official year, although they had unusual difficulties to contend with. During the first six months of the present year there were labour difficulties at most ports served by the Company. These were the cause of long delays and increased expenditure. The profits, however, were £48,672 as compared with £38,179 in the preceding year. No serious accident happened to the Company's vessels. After payment of all expenses, £25,000 was applied to depreciation ; £10,000 allotted to the payment of arrears of preference dividends, and a balance of £1525 carried forward.

Manchester Port Sanitary Committee. On the 14th inst. the steam yacht belonging to the Manchester Port Sanitary Committee passed along the whole length of the Ship Canal, partly on business and partly on pleasure. After inspecting a number of vessels the party were entertained by the Ship Canal Company at the old-fashioned residence formerly occupied by the Duke of Bridgewater. In the speeches which followed the refreshments, general satisfaction was expressed at the improved condition of the waters of the Canal since the Mersey and Irwell Committee began their operations in bringing about its purification ; also at the near approach of the completion of the deepening of the whole length of the Canal to 28 ft. Only the Manchester end remains to be scooped out. The use of the Lobnitz rock breaker has been of great service. It breaks the rocky bottom of the Canal into small bits, which are then easily removed. The cost, as compared with the use of explosives, is as one shilling compared to half a sovereign.

British Textile Machinery.—The exports of goods is increasing. The total value for August was £655,228 as against £535,232 for August, 1906, and the amount for the expired eight months of the current year was £5,225,322 against £4,274,062 for the corresponding period last year, and £3,454,383 for January to August, 1905. British India, Germany, France, Japan and the United States show the largest figures, while other countries in Europe took to the value of £167,097. Russia and all the European markets, except France, show an increasing demand for textile machinery.

The Staveley Coal and Iron Company have declared a total dividend for the year of over 20 per cent., and carry forward more than £33,000.

Copper.—The fall in the copper market has been going on apace during the present month, and there is no combination that can be thought of that would be strong enough to keep up prices to their recent enormous rate. The American brass trade has gone down as much as 40 per cent. with an equal decrease in the electrical trades. The other engineering consumption is still good, but will only account for about a fifth of the world's consumption.

The cotton importations season has now commenced. The first vessel to arrive at the Manchester Docks was the *Persian Prince*, with 3268 bales of Egyptian cotton. The Egyptian crop is reported as splendid, and worth £30,000,000.

During the month a record cargo of cotton from West Africa was discharged from the West Toxteth Dock, Liverpool. It came from Nigeria, and was composed of 1050 bales, which was reported as in splendid condition.

Morocco. Manchester trade with Morocco, owing to the troubles in that country, has been practically brought to a standstill, and our local shippers engaged in trade with Morocco ports state that they see no immediate likelihood of a resumption of their business in that quarter. The moment peace is restored stocks of goods are in readiness to be despatched. These consist chiefly of cloth. Our exports of cotton material to Morocco are valued at nearly £700,000 per annum, and August is the busiest month of the year for transit. It will be seen how serious a block has been occasioned to Lancashire manufacturers and Manchester and Liverpool shippers by the war in that part of Africa.

Coal.—The exports of coal from this country during August totalled over 5,842,000 tons, compared with 5,201,500 tons in the corresponding month last year. The figures for the first eight months of the year amount to 42,972,000 tons, an increase of nearly 5,000,000 tons on the exports during the first eight months of 1906. Germany and France are largely increasing their purchases from us. While our foreign coal trade continues at this rate, there is no probability whatever of any reductions in prices. Indeed, so far as can be seen ahead at present coal is likely to be still dearer. The demand at the Lancashire pits generally at present is more than they are able to supply except after considerable "waits." Miners' wages were raised another 5 per cent. the first making-up day after the 13th inst. This brings up their total to something like 50 or 55 per cent. above the original minimum. Strange to say, the miners, who are on "piece" terms, have their own peculiar methods of work. "Sufficient for the day is the evil thereof," is one of their mottoes. They are satisfied with three or four days' labour per week, and seldom, if ever, do more than five. At one colliery in the Manchester district it is not unusual to have from 60 to 70 men away day after day. The most trivial excuses sanction a "day off." Merchants' waggons stand on the sidings ready for filling, and they have to wait their turn, which is often a long one. With regard to house coal just now, it is believed stocks are being built up by the middle men in readiness for the winter. Householders are paying from 16s. 8d. to 21s. 8d. per ton for coal, which is an extraordinary price for dwellers among coal pits. Average prices at the pits' mouth at the present time are as follows :—Best house coal, 15s. to 16s. 6d. per ton ; secondary, 14s. to 15s. ; common, 12s. to 13s. 6d. ; burgy, 10s. 6d. to 11s. 4d. ; best slack, 9s. 6d. to 10s. 4d. ; medium, 8s. 6d. to 9s. ; lower qualities, 7s. 9d. to 8s. 4d. ; coal for bunkers and export, 13s. to 14s. 6d. f.o.t. at the tips ; furnace coke in good demand at varying prices, ranging from 17s. to 25s. per ton.

The Iron Trade of Lancashire, so far as manufacture of machinery is concerned, remains very satisfactory, but the price of pig iron has been gradually falling during the month. Stocks are low. Buyers only take small quantities. They have been waiting for a fall, and it has come. The outlook is on the side of the purchaser. The enormous exports of raw metal to the Continent of Europe and the Continent of America have been steadily decreasing. At the time of writing prices of pig and manufactured iron on the Manchester Royal Exchange were as follows :—Scotch metal, delivered Manchester docks : Eglinton, 69s. 3d. ; Dalmellington, 69s. ; Glengarnock, 71s. 6d. ; Gartsherrie, 72s. 6d. ; if landed at Heysham or Fleetwood 2s. 3d. per ton less money is accepted, and if put on the quay at Preston 1s. less. Middlesbrough G.M.B., 63s. 3d., delivered Manchester ; Derbyshire, 62. 6d. ; Staffordshire, 61s. 3d. ; Lincolnshire, 64s. 6d. (No. 3) ; do. foundry, 64s. ; do. forge, 63s. 6d. Hæmatites, West Coast, 75s. 6d., and East Coast 80s. f.o.t. Manufactured iron : Bars, £8 ; steel rounds and squares, £7 17s. 6d. ; flats, £7 5s. ; angles, £7 2s. 6d. ; joists, £6 10s. ; channels, £7 10s. ; tees, £7 7s. 6d. ; iron hoops, £8 7s. 6d. ; steel do., £8 15s. ; steel boiler plates, £8 12s. 6d. ; do. ship plates, £7 10s. to £7 15s. German, Belgian and French competition here has become stronger.

THAMES.

(*From our Own Correspondent.*)

London's Docks. The docks are an integral part of our city in more senses than one. Like it, they are vast in size, extending as they do from London Bridge to Tilbury. Many aspects of them are thus totally lost and with them the ships they hold. The Thames, it is not perhaps remembered, brings in one third of the imports of the kingdom and exports one-fourth, the trade being estimated at about three hundred millions pounds a year. Tilbury, farthest down, is the home of some of the largest boats, some of which run up to between 13,000 and 14,000 tons. With the Royal Albert and the East India Docks with their large liners, London

does not make a bad show. Then there are the relatively smaller ships in the London, West India, Surrey, Commercial and Millwall Docks and others unloading at wharves, clearly pointing to the fact that this large question of government cannot be settled offhand or by those who know nothing whatever about the matter.

Dock Co.'s Reports.—The London and India Dock Co. show an increase in tonnage for the past six months of this year of over 60,000 tons as compared with same period last year. The coastwise traffic decreased by about 30,000 tons, giving therefore a net increase of about this amount. After providing the usual charges, £75,569 was carried forward. The Surrey Commercial meeting was not as satisfactory as usual, as both the wood and grain trades, the two staples, had diminished, the former by 69,000 tons and the latter by about 37,000 tons. Their tonnage on sundries, however, increased by 83,000 tons. A dividend was declared of 2½ per cent. on both ordinary and preference stocks.

Messrs. Yarrow's Removal.—The time is approaching when this eminent firm will take their departure from the Thames. They are said to be ready and in working up north but are not hurrying their plans of departure in order, no doubt, not to inconvenience either themselves or their men. They give it out that they can work at 10 per cent. less cost in Scotland than what they can do in this district. If so, it is small wonder they can effect removal without inconvenience to themselves or their business. The change must mean a loss to the district generally.

The Port Jackson Training Ship.—This vessel is now in the South-West India Docks loading for Sydney and by the pamphlet issued by her owners, Messrs. Devitt & Sons, we have a history of the scheme inaugurated in 1890 by Lord Brassey in conjunction with the firm named. This is the largest vessel that has been employed for the purpose by the firm, and she is due to sail on her next voyage in about three weeks' time. A feature on this occasion is that in addition to one hundred *Warspite* boys to be carried there are four scholarships granted by the London County Council. These are each of the value of £25 and the holders will be indentured to the Marine Society for a period of two years.

Machinery Exhibition at Olympia.—This exhibition, which opened on September 19th has entailed considerable preparation. The whole of the interior was cleaned and painted beforehand without recourse to scaffolding, by the expedient of employing seafaring men, who carried out the work with expedition and free from accident of any kind, many tons of paint being required for the purpose.

The Thames Estuary.—A public enquiry held for the purpose confirmed the increase of 2s. in the poll tax at Dover. The Belgian Government considered the advisability of removing their service of steamers from Ostend in consequence, but apparently gave up the idea as impracticable. Thames Haven was one of the places mentioned in this connection Southend and Ramsgate others. Difficulties, however, presented themselves and the station on this side will still be Dover.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow.—There is not much that is new to report in connection with the shipbuilding industry of this district. The new business done has been on a small scale.

Submarines.—Messrs. Vickers, Sons & Maxim are building a curious steamer which has been designed to convey to foreign countries a couple of submarines, so as to be able to convey these somewhat delicate craft long distances in the safest way possible. Such a type of vessel can doubtless be used for other purposes when not employed in the carriage of submarine craft, and it is as well that the builders of sub-aqueous vessels should possess facilities for the safe removal of any submarines built for a foreign Power whose territory is a long way from here. It is understood that two of the submarines now building at Barrow are for the Mikado's navy. They are of the *Holland* type, for which the Vickers firm hold the patent, and are of the C class building at Barrow for the British Navy. They represent considerable improvements on the A class first built for the British Navy, and embrace all the scientific contrivances which the practical handling of these vessels has demonstrated as essential, first of all for the satisfactory performance of the work they would have to do in case of war, and secondly, with the view of securing the greatest possible safety to the men who have charge of these vessels. The lessons learnt by the builders by the accidents, some of them fatal, which have unfortunately occurred from time to time have been embodied in the new craft now under construction, and they therefore represent what are rightly considered the most up-to-date submarines yet designed. But further developments are being made from day to day in submarine construction, and new means of guiding the craft and propelling them alike when awash and when submerged are being brought to light as a result of scientific research and practical experiments. The C class of submarines have two torpedo tubes fitted in their port and starboard quarters forward, and they are likely to prove very efficient vessels.

High Speed Channel Turbine Steamer.—The work of building the new Isle of Man Steam Packet Company's turbine steamer at Barrow is proceeding rapidly. She is to be on her station next Whitsuntide, and is to be the fastest Channel steamer afloat. She will be launched before Christmas. Her turbine machinery is being pushed forward with all the rapidity possible where the highest class of workmanship is required.

Work in Hand.—The three London and North-Western steamers building at Barrow will soon be ready for launching and the Mexican transport ship is well in hand. The Indian survey steamer *Investigator* is now completed and ready for her trial. She is a beautifully modelled vessel, and is most elaborately equipped for the work she will be called upon to do on the shores of India. The Furness Railway Company's tug boat *Cartmel*, built by Vickers, Sons & Maxim has been launched, and on her trials has proved an exceedingly strong and capable vessel. She has been built to handle the heavy class of vessels which now frequent the port of Barrow, and also to be of service to a very heavy class of Admiralty and merchant ships built at the Barrow Yard.

The Russian Cruiser "Rurik."—The speed trials of the Russian armoured cruiser *Rurik* have been completed, but no details are to hand, as the Russian authorities object to the publication of details, but it is known that she exceeded the splendid speed she was designed for, and that she showed great economy in coal consumption. She has yet to undergo her gun trials, and then she will be ready to be handed over to the Russian Government.

New Electric Crane.—The new 150 tons electric crane built on Vickers, Sons & Maxim's new fitting-up wharf on the sides of the Buccleuch Dock, Barrow, will soon be completed and ready for testing. The wharf itself has been completed, and the work of dredging opposite the new pier will then be commenced. The heaviest and largest vessels yet designed or built will be able to get alongside this pier. The work of widening the passage way between the Ramsden and Buccleuch Docks is proceeding very satisfactorily, and it is expected to be ready for use this autumn. This passage way was originally built 80 ft. wide, but it will, when completed, be 100 ft. wide, the same width as the entrance to the Barrow Docks. When this work is completed Barrow shipbuilders will be able to undertake the construction of vessels of any length, 1000 ft. or upwards, and up to 100 ft in beam.

The Brazilian Battleships.—There has perhaps been more wild rumour about the Brazilian battleships building at Barrow and Elswick than there has been about any other boats since Barrow built battleships. They have been credited to Russia, China and the latest freak report is that they are intended really for America in case that country falls out with Japan. Whoever they are being built for one thing is certain, they are being constructed under the inspection of Brazilians, and that is corroboration at any rate. There is some talk of a third battleship, of which it is said the laying down is postponed. When one considers the cost of the two at present under construction one does not wonder at the postponement of the laying down of the third. The question that is occupying the minds of the powers that be is the propelling machinery of these two leviathans. It was first intended that they should have Parsons turbines, but Brazil hesitated following in the steps of the British Admiralty—why need not be discussed here—and it was ultimately decided to put in the ordinary reciprocating

engines. The "third" may have the turbines. This, of course, has meant the altering of the design of these vessels to some extent. The engines for both of the ships will be built at Barrow by Vickers, and are now in hand. Anent the adoption of the turbine by the British Admiralty it is interesting to note the attitude of other powers towards this class of propelling machinery by, say, Germany and America. The hesitation of Brazil may be a reflection of the American attitude. The latter country rather foolishly advanced the plea of a larger coal consumption and are only putting turbines in one of their new ships. That is, as results have proved in England, a very short-sighted policy. The extra cost of coal is more than recompensed by the saving in weight which permits of heavier armour and guns. It would be interesting to know what the feeling of Germany is on the matter. Perhaps it is too English.

West Cumberland.—A steady run of business characterises the shipbuilding trade at Maryport and Workington. The builders there are very well supplied with orders, and when they are not they know exactly what sort of ships to build and those that are always assured of finding customers. They are, therefore, steady and regularly employed.

Shipbuilding Material.—The demand for shipbuilding material is fairly well maintained, but the plate mills have not been working regularly, as they have had to wait for specifications. Ship plates are lower in price at £7 10s. net cash per ton.

Hæmatites.—There is a much weaker tone in the hæmatite trade, and prices are down at 76s. for Bessemer mixed Nos. Stocks have been reduced to 9817 tons.

Shipping.—The shipments of iron and steel this year have reached up to date 649,669 tons, an increase of 70,467 tons over the corresponding period of last year.

SOUTHAMPTON.

(*From our Own Correspondent.*)

Messrs. Harland & Wolff's Repairing Works.—Rapid progress is being made with the new repairing works which are being built here by the Waring White Building Company for Messrs. Harland & Wolff, but the premises will not be ready for complete occupation till early in the new year. The office buildings are in an advanced state, and the main roof trusses and girders are being rapidly erected for the shops, and it is anticipated that part of the works will be running in time for some of the repairs to the *Suevic* to be attended to in the works.

The New Dock at Southampton.—Preparations are now in progress for commencing the construction of the new wet dock here. The dock, which will be about 30 acres in extent, will be able to accommodate the largest vessels afloat or likely to be built for many years to come. The contractors are Messrs. Topham, Jones & Railton. Several tugs have arrived and others are *en route* from Gibraltar, where the contractors have just finished a large contract for the Government. A large dredger has also arrived and will be engaged in the work.

The White Star Liner "Suevic."—Work has been in progress for some time past on the salved after-portion of this vessel preparatory to fitting the new bow which is being built by Messrs. Harland & Wolff, and which is now rapidly approaching completion. The work being completed as far as possible above the water line the vessel was dry docked in the Trafalgar Dock on the 10th September last, to enable work to be commenced on the under-water portion. As she now lies in the dry dock she presents a unique spectacle. The new bow portion is expected to be in Southampton this month, and the work of joining the two portions of the vessel is expected to occupy about two months, so that the vessel ought to be completed ready for sea about Christmas. The bow portion is being built with the bow to water and will be launched and towed round here, and we think this is the first instance of a portion of a ship's hull being launched. In the case of the lengthening of the *Scot* and the building of the new part on to the *Milwaukee*, this was done whilst the vessels were on the slips.

BELFAST.

(*From our Own Correspondent.*)

Messrs. Harland & Wolff.—There has been considerable amount of speculation as to whether the leviathan which the Queen's Island firm are to build for the White Star line is intended to eclipse the Cunarder *Lusitania* and *Mauretania* in speed as well as in size. This vessel's dimensions will be considerably in excess of those of the latest additions to the Cunard fleet; but, so far as can be gathered, nothing definite has yet been settled in regard to the question of speed. As to the method of propulsion, no doubt the performances of these other vessels will be watched with interest, but it is probable that the White Star liner will be driven by a combination of reciprocating and turbine engines, which it is understood will be adopted in the big Hamburg-American liner referred to in a recent issue.

Messrs. Harland & Wolff will shortly have three launches in close succession—the Royal Mail Steam Packet Company's *Asturias*, the big barge for the Anglo-American Company, and the new forward end of the White Star liner *Suevic*. Overtime is being worked on the last-named, with a view to launching early in October. After a series of highly satisfactory trials the Hamburg-American liner *President Grant* left Belfast Lough for Hamburg on 3rd September. This vessel is the second of the two which were originally intended for the Leyland line, and which, after lying up for a long time in the Musgrave Channel, were eventually taken over by the German company. She is 616 feet long, 68 feet broad and 45 feet deep, with a gross tonnage of over 18,000 tons. The propelling machinery consists of two sets of balanced quadruple-expansion engines. This company has purchased the White Star liner *Gothic*, which has arrived at the Queen's Island, where she will be overhauled and altered to suit the requirements of her new owners.

Messrs. Workman, Clark & Company are making rapid progress with their order for nine steamers for the Lloyd Brazileiro Company. On 6th September they put in the water the fifth of these new vessels. The *Mantiqueiro*, as she is named, is of a different class from the four already launched, being intended for the company's coast and river trade. She is 276 feet long, 44 ft. 9 ins. broad and 17 ft. 6 in. deep, with a gross tonnage of 2000 tons. On the 27th of August this firm launched a new twin-screw steamer named *Nerehana* for the Tyser Line. She is a sister ship of the *Whakaru*, recently built by them for the same owners, and is 466 ft. long, with a gross tonnage of 6500 tons. The propelling machinery consists of two sets of triple expansion engines, steam being taken from four single-ended boilers working under Howden's forced draught system.

The Dockers' Strike is practically at an end. So far as the Belfast Steamship Company is concerned it was brought to a finish shortly after last month's notes were published, the men returning on precisely the same terms under which they had been previously working. The strikers were led by a man who, by his violent and inflammatory speeches, and by his encouraging wanton destruction of property, placed himself beyond the pale of recognition on the part of the shipping companies. They rightly declined to treat with the men through him, in any shape or form; and ultimately the Belfast Steamship Company's labourers took the matter into their own hands and surrendered unconditionally. It is only a matter of time before those employed by the other companies follow suit. Either that or they will have to seek occupation elsewhere, for the Midland Railway Company, to whom belong the Heysham and Barrow steamers, and the Lancashire and Yorkshire and London and North Western Railway Companies, who are joint owners of the Fleetwood steamers, are too strong to be compelled to recognise the dockers' union. Furthermore, the workers are at last awakening to the fact that they have been led by the nose by a man who boasted of thousands of pounds rolling into the coffers, but could only offer a mere pittance as each successive pay-day came round.

Graving Docks.—At a recent meeting of the Harbour Board a satisfactory report from the Trust's consulting engineers on the progress of work at the new graving dock and in connection with the Alexandra Dock repairs was read. At the former, operations were necessarily delayed

for some months owing to the subsidence at the Alexandra Dock which closely adjoins it, but the work is now proceeding rapidly. It is intended to have the restoration of the latter dock completed by 1st January, when it will be ready for use. Considerable delay was caused through the difficulty in obtaining coal during the strike.

JUNIOR ENGINEERS.

XIII.*

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Smithing.

With the majority of firms the usual practice is to obtain all the heavy forgings from outside sources, as, with the exception of those contracting for a class of work that will allow of the upkeep of large machines and appliances, the specializing manufacturer can produce the rough finished article cheaper and in less time than would be feasible where shafting and connecting rods form but a small part of the entire output; the smaller parts, however, a moderately equipped smith shop is capable of producing and although perhaps this branch does not lend itself well to descriptive interest, a few notes on tools and methods may not be out of place.

For ease in manipulating the heavier work, the large furnaces and steam hammers are grouped together with the necessary lifting appliances, whether of the overhead traveller or fixed jib type; the furnaces may be either gas or coke fired, of rectangular shape with a movable door, and the hammers or presses may be operated by either steam, pneumatic or hydraulic power.

The smaller forges are now-a-days of the down draught type, the waste gases passing upward into a hood over the fire are led by suction up and over the wall at the back of the hearth and thence by ducts direct to the outside of the building, thus largely assisting in preserving a purer atmosphere within the building and allowing more freedom for travelling cranes. The air blast to the fire passes in the usual manner through a tuyère—water-cooled to prevent fusion—and is generated either from a fan or blower.

Formerly the only machines employed were those for the manufacture of bolts, nuts and rivets, now however, when everything is crystallizing to standardization and repetition, welding and forging machines are coming more and more into demand, so much so that almost every fire will keep a machine working, the outlay in dies for every job being fully met by the increased output and reduction in machining required.

Pneumatic power is largely employed in the operation of these machines, one half of the die being fixed into the block, the other half into the upper portion, which, acting as a hammer or tup, forms the material, by successive blows, into the required shape. Larger dies are similarly used in conjunction with the steam hammers for finishing part or the whole of a job after it has been roughed out into shape.

The smaller tools employed at the anvil may be classified as fullers, swages and tongs, these being of varying shapes and sizes suited to each special operation. The fullers, as distinguished from the swages, are convex to the material and are employed in forming shoulders and cogging or drawing out the metal and generally finishing off the hammer work; the swages are concave to the material and are made in various sections, round and square, and are employed as in the reduction of the diameter of a bar. These tools are made to pair top and bottom, the one having a square shank forged upon it to fit the hole in the anvil formed for the purpose, the other being fitted with a handle to steady it beneath the hammer. The number and description of tongs will of course vary with the class of work, the section of the gripping end being circular, square or formed in various ways best adapted to their special utility. The other tools comprise punches, drifts and sates, the sate being the smith's chisel.

The materials of which the tools are formed depend on the work required from the tool, hammers are made from cast steel and hardened on the striking face, and were two such hardened surfaces used against one another either or both might splinter, hence such tools as top fullers and swages, sates and drifts are of milder steel and unhardened. The bottom fullers and swages may be either of steel or iron case hardened, and for the rougher class of dies or cresses, iron is largely used; where, however, a die must be accurate, and remain so for a large number of impressions, steel is preferably employed; tongs or pliers not required to stand any heavy strain may be either of iron or mild steel.

* For Articles I. to XII., see last twelve issues.

Moulding Machine.

By inadvertence in our last issue, the plate showing a hand moulding machine was substituted for that showing the hydraulic power moulding machine, as described in the letterpress and noted as Fig. 1.

Altenbach Limited, of Brighouse, Yorks., have commenced business as manufacturers of castings in malleable iron, steel alloy and special steels, claiming as a special feature to make mild steel castings for breakdowns within a very short time.

Messrs. Newton & Nicholson, of Tyne Dock, South Shields, the makers of the well-known Taylor's patent corrugated metallic packing, have opened a London office at Billiter House, Billiter Street, E.C., for the convenience of their London customers. This firm have recently gone in for the making of cargo blocks, snatch blocks, coal gins, etc., and a full range of samples of these will be on view at the London office.

Corrosion and Accumulation.—These are two enemies to the maintenance of sustained efficiency and economy which are being daily fought against and overcome, with more or less success, by many different and varied means. The results of experiments made to determine what causes wastage and how to prevent it, or what causes accumulations and how to overcome such, are always interesting, besides being valuable as incentives to study the reasons of things as we find them in the course of duties which demand that cure and prevention must lie in the foreground. The severe pitting action which some years ago was found to attack the heating surfaces of boilers led to several theories and many experiments to determine what causes combined to form the action. The mill scale being allowed to remain on the plates was considered to be detrimental to them by inducing an action, which resulted in wastage; observation and experiment gave evidence of the truth of this theory; we have witnessed such evidence and in a very marked extent where the mill scale has been abnormally present on the plates; the result was a recommendation to pickle the plates in order to remove the scale. Sample plates suspended in salt water of different densities and contained in bottles, with and without other metals in contact, were experimented with, and resulted in the recommendation to use zinc in contact with the furnace and combustion chamber plates, the sacrifice of the zinc saving the more solid structure of the boiler. The cost of zinc as a preservative being considerable, many other expedients have been brought forward from time to time with a view to lessen the annual charges for up-keep, but probably the metal in question stands first in the field, especially where there is a tendency to wastage in the internal parts around the furnaces and combustion chambers. Trials were made some years ago with balls of zinc placed in cups between the boxes of tubes in the water spaces. Through the centre of the balls a copper bar was cast; copper wires were attached to either end of the bar in close and clean contact, the other ends of the wires were attached to the combustion chamber crown and the furnace respectively; there was thus, to start with, a good clean connection between the combustion chamber, the zinc and the furnace. It was, however, found from experience that the contacts soon became broken, due to disintegration of the zinc ball, or oxidation breaking the contact. Subsequent experiment and experience have brought about several improvements in the manufacture and attachments, and we note that the zinc balls are now being adopted under what is termed the "electrogen" system, with a view to obtain all the good results from the use of zinc with a more economical application of it. This system is fitted by the Glasgow Patents Co., the zinc balls being made of virgin spelter, pure copper with screwed stud connections.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Maylands.—On August 22nd, Messrs. William Gray & Co., Limited, launched at West Hartlepool the handsome steel screw steamer *Maylands*, which they have built for Messrs. The Wilson Shipping Company, Limited, West Hartlepool (Messrs. Joseph F. Wilson & Company, managers). She will take the highest class in Lloyd's Register, and is of the following dimensions, *viz.* :—Length overall, 356 ft. 6 in. ; breadth, 50 ft. and depth, 27 ft. 7 in., with long bridge, poop and topgallant forecastle. The saloon, state-rooms, captain's, officers' and engineers' rooms, etc., will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom and aft peak ballast tank, seven steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig and all requirements for a first-class cargo steamer. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders $25\frac{1}{2}$ in., $40\frac{1}{2}$ in. and 67 in. diameter, with a piston stroke of 45 in. and two large steel boilers for a working pressure of 180 lbs. per square inch. The ship and machinery have been constructed under the superintendence of Mr. J. Maddison on behalf of the owners, and the ceremony of naming the steamer *Maylands* was gracefully performed by Mrs. Joseph F. Wilson, of Pangbourne, West Hartlepool.

Washington.—On August 22nd, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, launched the handsome steel screw steamer *Washington*, built for the Furness Line. She is of the following dimensions :—336 ft. by 47 ft. by 24 ft. 10 in,. having single deck, poop, bridge and topgallant forecastle, and has been built to the British Corporation Registry's highest class. A double bottom is fitted throughout on the cellular principle, and the fore and after peak tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stringers, giving clear holds for the storage of bulky cargoes. Five water-tight bulkheads divide the holds into six water-tight compartments, wood grain divisions are fitted in the holds. She also has extra large cargo hatches, five steam winches which are supplied with steam from a vertical multitubular donkey boiler, and is replete with all the latest improvements for rapid loading and discharging. A powerful quick-warping steam windlass is fitted forward for the working of the cables, and steam steering gear is fitted amidships with hand screw gear aft. Accommodation for captain and officers is arranged in poop, engineers in houses amidships, crew and firemen in forecastle. The sanitary, ventilating and lighting arrangements have received special attention, and have been effected on the most approved lines. Triple expansion engines are being supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 24 in., 38 in., 64 in. by 42 in., two large S.E. boilers 160 lbs. pressure. The vessel was named *Washington*.

Nanthoron.—On August 23rd, Messrs. William Gray and Company, Limited, launched at West Hartlepool the handsome steel screw steamer *Nanthoron* for Messrs. Griffiths and Sandey, Cardiff. She will take the highest class in Lloyd's Register and is of the following dimensions, *viz.* :—Length overall, 342 ft. ; breadth, 47 ft. 6 in. ; and depth, 25 ft. with long bridge, poop and topgallant forecastle. The saloon, state rooms, captain's, officers' and engineers' rooms etc. will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep frames cellular double bottom and large aft peak ballast tank, six steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass large patent donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig and all requirements for a first class cargo steamer. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in. and 64 in. diameter, with a piston stroke of 42 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. The ceremony of naming the steamer *Nanthoron* was gracefully performed by Mrs. Allan Gough, wife of Lieut.-Col. Gough, Galliwig, Pwllheli, North Wales. The following ladies and gentlemen were also present at the launch :—Col. Allan Gough and Mrs. Gough, Pwllheli ; Mrs. and Mr. T. Sandey, Mr. and Mrs. C. Sandey, Cardiff ; Capt. R. H. Griffiths, Pwllheli ; Mr. and Mrs. J. G. Penn, Cardiff ; Mrs. Jones, Miss Baines, West Hartlepool ; Mrs. and Miss Baines, Leicester ; Principal and Mrs. Forsyth, London ; Mr. N. T. Daniel, superintendent, Cardiff ; Mr. Wakefield, London, and others.

Bellerophon and **Bellona.** On August 24th, there were launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, two handsomely modelled steel screw trawlers, the principal dimensions being 105 ft. by 21 ft. 6 in. by 11 ft. 3 in depth of hold. The vessels have been built to the order of Messrs. The Consolidated Steam Fishing and Ice Co. (Grimsby), Ltd., of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes and Co., of Hull, and are replete with all the latest improvements for fishing purposes. As the vessels left the ways they were gracefully christened the *Bellerophon* by Miss Marsden of Grimsby, and *Bellona* by Miss Frusher, of Grimsby, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Ocland.—On August 26th, there was launched from the yard of the Sunderland Shipbuilding Company, Ltd., a screw steamer of quite a new type. This vessel is the invention of Mr. H. Burrell, of Glasgow, and is what he calls the "straight-back," and judging from the dimensions, deadweight carrying and light draught of water, is destined to make a name for herself in the money-earning ventures of the future. The vessel is of the following dimensions and particulars, *viz.*:—305 ft. length between perpendiculars, by 47 ft. broad by 24 ft. deep, classed highest at British Corporation, and has been surveyed during construction by Captain Bruu. The time charter upon which the vessel is fixed for four years demands that the boat shall be automatically trimmed and mechanically discharged of her 5000 tons of cargo in not less than thirty-six hours by her own electrical equipment, and that she shall steam ten knots when laden with 5100 tons all told. It is confidently expected by the inventor and Captain Bruu that there will be no difficulty whatever in conforming to this stipulation. The Turbo dynamo to drive the electrical gear is supplied by Messrs. C. A. Parsons & Co, the electrical cranes are by Messrs. Craig & Co., of Glasgow, the Edwards' pumps by Messrs. Mirrlees & Watson, and the electric lighting and cable plant by Messrs. Harvey & Co., of Glasgow. The main engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 24 in., 40 in. and 65 in. by 42 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of H. Fredriksen, Esq., of Sandviken, Norway, and on leaving the ways was gracefully named *Ocland* by Mrs. Fredriksen.

Clan Sinclair.—On August 27th, Messrs. Wm. Doxford and Sons, Ltd., launched the steamship *Clan Sinclair*, a duplicate of the steamship *Clan Graham* now finishing, being one of the improved type of clear 'tween deck vessels building for the Clan Line Steamers, Ltd., Glasgow. She carries 8000 tons and steams eleven knots. The vessel was named the *Clan Sinclair* by Miss Dorothy Doxford, Cleadon.

Helena. On August 27th, Messrs. Craig, Taylor & Co., Limited, launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled single-deck screw steamer of the following dimensions, *viz.* : 291 ft. by 38 ft. 4 in. by 20 ft. $7\frac{1}{2}$ in. She is built of steel, to the highest class in Lloyd's, under special survey and to Dutch Law requirements, and has poop, bridge and topgallant forecastle ; water ballast in double bottom fore and aft and in peaks. She is equipped with patent steam windlass with quick-warping ends, steam steering gear, five steam winches, suitable donkey boiler, pole masts with the usual derricks and all the latest improvements for rapid loading and discharging. The accommodation for captain and officers is neatly fitted up in deck-house amidships, the engineers being in deck-house alongside engine casing and the crew in the poop. Her engines have been constructed by the North-Eastern Marine Engineering Co., Ltd., Sunderland, the cylinders being 19 in., 31 in., 51 in. by 33 in., with two large steel

boilers working at 180 lbs. pressure. The vessel has been built to the order of A. C. Lensen, Esq., of Terheuzen, under the superintendence of W. C. Carter, Esq., of London. As she left the ways the was gracefully christened the *Helena* by Miss Lensen, daughter of the owner. This vessel is a duplicate of the *Elisabeth*, recently launched for the same owner.

Calcutta.—On August 28th, this vessel was launched by Messrs. Furness, Withy & Co., Limited, Hartlepool, and has been built to the order of Messrs. Nelson, Donkin & Co., London. The vessel exceeds 360 ft. in length and has large measurement capacity, and takes Lloyd's100 A1 class. She is constructed on the deep frame principle with single deck, poop, bridge and forecastle, having clear holds for the bulky stowage of cargo, the hatches being large and worked by six powerful steam winches, double derricks being fitted to each hatch. Cellular double bottom extends all fore and aft, the fore and after peaks being available as tanks. Wood shifting boards will be fitted throughout, and direct steam patent windlass, steam and hand-steering gear, and all up-to-date auxiliaries will be included in the vessel's outfit. Accommodation for the captain and officers will be provided in large deck-houses on the bridge deck, the crew being berthed in the forecastle. She will be rigged as a two-masted fore and aft schooner. The machinery will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, the sizes of cylinders being 24 in., 39 in., 66 in. by 45 in. stroke, steam being supplied by two single-ended boilers, 16 ft. by 10 ft. 6 in. long, working pressure 180 lbs. The vessel was gracefully christened *Calcutta* by Miss Winnie Sivewright, Hartlepool. The owners were represented by Mr. Percy B. Glanville, London.

Vrilla.—On August 28th, Sir Raylton Dixon & Co., Ltd, launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw steamer built with cantilever frames on Harroway & Dixon's, John Priestman's and Livingston and Sanderson's patents to the order of Messrs. The Adelaide Steamship Co., Ltd., of Adelaide, South Australia, to fulfil the special requirements of the owners' extensive coal trade. The vessel is being built to the highest class at British Corporation single-deck type, her leading dimensions being 286 ft. 4 in. by 40 ft. 7½ in. by 20 ft. 11 in. moulded, and will carry about 3300 tons on a light draught of water. A large steel deck-house on poop at fore end of boiler casing will be fitted up, containing captain's room, saloon and officers' accommodation, with wheelhouse above, while the engineers will be berthed at sides of engine casing and crew in aft end of poop. She will have four exceptionally large hatchways, eight derricks and four gaffs, and will be equipped with powerful steam winches and two frictional winches, electric light and all the latest and most modern appliances for the rapid handling of cargo. The vessel will also carry about 1050 tons of water ballast 400 tons of which will be located in angular tanks under the deck and the remainder in double bottom and peaks. She will be fitted with engines placed aft by Messrs. Richardsons, Westgarth & Co., Ltd., Middlesbrough, 20½ in., 33 in., 54 in. by 36 in. stroke, with two large single-ended boilers working at 180 lbs. pressure. On leaving the ways she was gracefully named *Urilla* by Mrs. Willimott, wife of Mr. C. S. Willimott, the manager for Messrs. T. S. Yuill & Co., London agents of the Adelaide Steamship Co., Ltd. The hull and engines are being constructed under the superintendence of Captain Charles Dingle and Mr. James Stewart, of Newcastle-on-Tyne, as consulting engineer.

Karanja.—On September 7th, Messrs. Robert Thompson and Sons, Ltd., launched from their Southwick Yard a finely modelled self-trimming collier, built for Messrs. The Unison Steam Shipping Co., Ltd., of London. The vessel is of the raised quarter and well deck type, and built to take the highest class in Lloyd's. Her principal dimensions are, length, B.P., 264 ft.; breadth, 38 ft. 6 in.; depth moulded, 19 ft. 6 in., and she is designed to carry about 2660 tons deadweight on a light draught of water, and fitted with deep bulb angle framing, dispensing with hold beams to leave holds clear of all obstructions. There are four very large hatchways, specially arranged to make the vessel perfectly up-to-date as a self-trimmer, and to facilitate rapid loading and discharging of cargo is provided with eight powerful steam winches, with latest improvements, placed on raised platforms, and in addition to the usual derricks, double gaffs will be fitted for each hatch, the masts being amply strengthened to receive the derricks. To enable her to make quick return voyages, 650 tons of water ballast is provided for, throughout the cellular double bottom and fore and after peaks, the former being divided longitudinally and athwartships, and fitted with tank suction pipes and extra large ballast donkey for quickly pumping out water ballast. The holds will be ceiled throughout with American elm. The tank top under boilers and lower and bridge bunkers are coated with patent enamel. The mooring arrangements have also received special attention, for in addition to the large fairleads and bitts, steel wire compressors will be placed on poop and forecastle decks, the pipes in bow chocks being of ample size to take cables when riding in a strong tideway. Accommodation for captain and officers is provided in the poop, the saloon being tastefully fitted up in different shades of polished oak. Spacious rooms for the engineers are arranged at sides of engine casing under bridge deck, the petty officers and crew being berthed in forecastle. At forward end of main bridge the chart house is erected, with lower flying bridge on top, also large teak wheelhouse, the latter carrying upper flying bridge. The steam winches, also combined steam and hand-steering gear are supplied by Messrs. John Lynn & Co., Ltd., and the steam windlass by Messrs. Emerson, Walker & Thompson Bros., Ltd. The engines, of the triple expansion type, are by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, having cylinders 20 in., 33 in. and 54 in., with a stroke of 36 in., steam being supplied by two extra large boilers working at 180 lbs. pressure. During construction both hull and engines have been under the personal supervision of the owners' superintendent, Mr. W. Gates, of South Shields. As the vessel left the ways she was gracefully christened *Karanja* by Miss Gordon, daughter of C. W. Gordon, Esq., one of the managing owners. There was a large company present and on returning to the offices, light refreshments were partaken of and the usual toasts proposed and responded to, and Mr. R. C. Thompson, on behalf of the builders, presented Miss Gordon with a handsome sapphire and diamond crescent, as a souvenir of the occasion.

Thor.—On September 9th, Messrs. Ropner & Son, Stockton on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*, length, 370 ft.; breadth, 52 ft. 6 in.; depth, 27 ft. 3 in. The vessel is built to the highest class of the British Corporation for foreign account and will be fitted with the builders' patent improved trunk deck with clear holds and deep frames. The vessel has double bottom for water ballast, also in fore and after peaks, with additional water ballast at the sides of the trunk deck. The vessel will have a deadweight carrying capacity of about 7300 tons. The engines will be of the triple expansion type by Messrs. Blair & Co., Ltd., of Stockton on-Tees. The steamer will have the usual full and complete outfit for loading and discharging cargoes expeditiously. As the vessel left the ways she was christened *Thor*.

Elterwater.—On September 10th, the Blyth Shipbuilding Co., Ltd., launched from their shipbuilding and graving dock works the fine steel screw steamer *Elterwater*, built to the order of Messrs. The Elterwater Steamship Co., Ltd., of Newcastle (Messrs. Sharp & Co., managers). This vessel, which measures 244 ft. in length with a beam of 33 ft. 6 in. has been constructed under Lloyd's special survey to class 100 A1. She is of the raised quarter-deck type, having short bridge and topgallant forecastle. The accommodation for captain is provided in the bridge, engineers and officers in sidehouses on raised quarter-deck, and crew will be berthed in topgallant forecastle. The *Elterwater* is specially adapted for the coal and ore trade, having extra large self-trimming hatches together with the best and latest design of deck machinery for the quick and economical working of the cargo, comprising four steam winches by John Smith & Sons, steam steering gear by Donkin & Co., donkey boiler by The Blake Boiler Wagon & Engine Co., and Emerson Walker's patent windlass. Triple expansion engines of good power will be supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Sunderland. As the vessel glided down the ways, the christening ceremony was gracefully performed by Miss Sharp-Naters, of Stelling Hall, Stocksfield. An adjournment was afterwards made to the offices of the shipbuilders, when the success of the *Elterwater*, her owners and

other toasts were honoured. The hull and machinery have been constructed under the supervision of Mr. Jos. R. Scott, of Newcastle.

Ladywood.—On September 10th, Messrs. Osbourne, Graham and Co. launched from their yard at Hylton, Sunderland, the steel screw steamer *Ladywood*, which they have specially constructed for the well-known trade of Messrs. Wm. France, Fenwick & Co., Ltd., of Sunderland and London, and which is the sixth vessel of this type for this firm. She is built as a self-trimming collier, and carries 3100 tons on a shallow draught, and has been constructed to take Lloyd's highest class. The accommodation for the officers has been fitted up in the poop, the cabins, saloon and mess room being tastefully fitted out in hardwood. The engineers' accommodation is fitted around the engine and boiler casing, under the after end of the bridge. The vessel is equipped with the most modern appliances for economical working of cargo, the winches, steam windlass and donkey boiler all being supplied by Messrs. Clarke, Chapman & Co., Ltd., of Gateshead, and steering gear by Messrs. Donkin & Co., of Newcastle. As the vessel left the ways she was gracefully christened by Mrs. H. L. Pattinson. During construction, the hull has been under the superintendence of Messrs. Squence & Ingram, of Sunderland, and the machinery has been inspected by Messrs. Thompson & Eyres, of Sunderland. Engines are to be supplied by Messrs. Geo. Clark, Ltd., of Sunderland, and have cylinders 20½ in., 33 in., 54 in. by 39 in. stroke, with two large boilers working at a pressure of 180 lbs.

Marjorie and **Lark.**—On September 10th, the steam trawlers *Marjorie* and *Lark*, built respectively to the order of the Fleetwood Steam Fishing Co., Ltd., Fleetwood, and the Pioneer Steam Fishing Co., Ltd., Grimsby, were launched from the yard of Earle's Shipbuilding and Engineering Co., Ltd., Hull. The dimensions of these sister vessels are: length 135 ft., breadth 23 ft., depth 13 ft. The vessels have been built under Lloyd's survey for 100 A1 class steel, and are provided with the usual trawling outfit, and constructed with a raised forecastle to encounter heavy weather. The machinery will consist of a set of triple expansion engines, having cylinders 12¾ in., 22 in., 36 in. diameter by 27 inches stroke, steam being supplied by a large single-ended cylindrical boiler, working at a pressure of 180 lbs. per square inch. The naming ceremony was performed by Miss Marjorie Moody and Miss Evelyn Brown (Grimsby) respectively, and amongst those present were Messrs. Thos. Robinson, John Walker, Giles Mills and Miss Janie Taylor (Grimsby), Mr. Brook-Fox, Mr. and Mrs. Tyacke, Mr. and Miss Palethorpe and Mr. Sturrock.

Steamer.—On September 10th, Messrs. Wm. Doxford and Sons, Ltd., of Sunderland, launched a steamer of the following dimensions, 350 ft. B.P., breadth 49 ft., depth moulded 26 ft. 6 in. and has been designed to carry 6,000 deadweight on 22 ft. 6 in. She is built to Bureau Veritas highest class of the turret deck type with the builders' improved system of framing; cellular double bottom is fitted throughout, both fore and after peaks being also arranged as tanks. Her deck machinery consists of seven large winches situated on turret deck, together with the usual steam windlass, steam steering gear and warping winch aft on poop deck. Her propelling machinery consists of a set of triple-expansion engines, 25 in., 41 in. and by 66 in. by 45 in. stroke, taking steam from two large single-ended boilers, 16 ft. 3 in. by 11 ft., working at 160 lbs. pressure. Accommodation for the captain and officers is situated amidships, the crew being housed aft under poop. The vessel has been superintended while under construction by Messrs. Flannery, Baggallay and Johnson, of London, Liverpool and Rotterdam.

Boreas and **Bucentaur.**—On September 11th, there were launched from the shipyard of Messrs. Cochrane & Sons, Shipbuilders, Selby, two handsomely modelled steel screw trawlers, the principal dimensions being 105 ft. by 21 ft. 6 in. by 11 ft. 3 in. depth of hold. The vessels have been built to the order of Messrs. The Consolidated Steam Fishing and Ice Co. (Grimsby) Ltd. of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes and Co. of Hull, and are replete with all the latest improvements for fishing purposes. As the vessels left the ways they were gracefully christened the *Boreas* by Miss Marion Darnley, of Hull and *Bucentaur* by Miss Nancy Darnley, of Hull, after which the company adjourned to the builders' offices, where the customary toasts were given and responded to.

Steel Screw Steamer.—On September 11th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, a steel screw steamer of the following dimensions: length, 331 ft., breadth, 48 ft., depth moulded, 24 ft. 4½ in., and to class 100 A1 at Lloyd's on the single deck rule. This vessel has water ballast right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including six double-cylindered steam winches, direct acting steam windlass, steam steering gear by Messrs. John Lynn & Co., of Sunderland, and Hastie's screw gear aft. The engines, which are to be supplied by Messrs. North-Eastern Marine Engineering Co., Ltd., of Wallsend, are of the triple expansion type, having cylinders 24 in., 40 in., and 65 in. by 42 in. stroke and working at a pressure of 180 lbs.

Orsova.—On September 19th, Messrs. R. Craggs & Sons, Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer 362 ft. long by 49 ft. 9 in. beam by 25 ft. 10 in. depth. This vessel is being built to the order of the Hungarian Levant Steamship Co., Ltd., of Budapest, under special survey, to take the highest class under Lloyd's three-deck rule, one deck laid having poop, bridge and forecastle. The specifications of both hull and machinery are very complete in every way to fulfil the owners' special requirements. Cellular double bottom is fitted throughout for water ballast, and in fore and after peaks, the total amount being about 1220 tons. A special feature of this vessel's construction is the arrangement of clear holds, the deck being supported upon girders and wide-spaced mast pillars placed well clear of hatch sides. The construction of hull and machinery has been carried out under the superintendence of Mr. Walter J. Milne. Powerful steam winches are provided of the most approved type, steam steering gear is also supplied, and improved quick warping steam windlass is fitted forward. The arrangements for handling ship and cargo are most complete in every respect. The machinery will be fitted by the North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne, and will have cylinders 23½ in., 39 in., 66 in. by 45 in. stroke, steam being supplied by three large single-ended boilers working at 180 lbs. to the square inch. Miss Margaret Milne of North Shields performed the christening ceremony and named the steamer *Orsova*.

Snowdonian.—On September 19th, Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length overall, 371 ft. 6 in.; breadth extreme, 51 ft. 9 in.; depth moulded, 24 ft. 10 in.; deadweight capacity, 6650 tons. This steamer, which has been built to the order of Messrs. Owen & Watkin Williams & Co., of Cardiff, will class 100 A1 in Lloyd's Register and has been built under special survey. She is a single-deck steamer built to the three-deck rule with poop, long bridge, and topgallant forecastle. Accommodation for captain, officers and engineers is provided in steel deck-houses on bridge deck, crew being berthed in the poop. A cellular double bottom throughout and peak tanks are fitted for water ballast, and equipment includes six steam winches, horizontal multitubular donkey boiler, steam windlass with quick-warping ends, stockless anchors, steam steering gear, etc., etc. The engines, by Messrs. Blair & Co., Ltd., have cylinders 25 in., 41 in. and 67 in. with a stroke of 45 in., steam being supplied by two single-ended boilers having a working pressure of 160 lbs. The vessel during her construction has been supervised by Mr. Thos. A. Reed, consulting engineer, of Cardiff. As the vessel left the ways she was christened *Snowdonian* by Mrs. D. Stonor Crowther, of Huddersfield.

LAUNCHES—Scotch.

Jeanara.—On August 20th, there was launched from the shipbuilding yard of Messrs. David & William Henderson and Co., Ltd., Partick, a large steel screw cargo steamer, which they have constructed to the order of Messrs. Maclay and McIntyre, of Glasgow. This latest addition to the fleet of vessels owned by this firm is in length 400 ft., breadth 50 ft., with a depth of 28 ft. 8 in. having a gross tonnage of about 4500 tons, and will be classed in Lloyd's 100 A1 Strengthened Spar Deck Class. She has been fitted with all the latest improvements to ensure the rapid and safe working of the

large cargo which she has been designed to carry, including eight powerful winches and also large derricks fitted at the hatches. A complete installation of electric light has been fitted throughout the vessel. Steam steering gear is fitted amidships, the saloon and officers' accommodation is on the fore end of bridge deck, and a chart-room and wheelhouse have been built above this, with a bridge which will give every facility to the officers in the navigation of the vessel. A set of triple expansion engines will be supplied and fitted by the builders, having cylinders 25 in., 41 in. and 67 in. diameter by 4 ft. stroke, also two large single-ended boilers working at a pressure of 175 lbs. On leaving the ways the vessel was gracefully named *Jeanara* by Mrs. T. W. McIntyre, of Kirkmichael House, Maybole.

Steel Screw Steamer.—On September 4th, Messrs. Archd. McMillan & Son, Ltd., Dumbarton, launched a steel screw steamer for service on the Canadian Lakes. The vessel is about 260 ft. long and the machinery, which is fitted aft, is being supplied by Messrs. Muir & Houston, Ltd., Glasgow.

Murtinho.—On September 10th, the *Murtinho*, the last of the three cargo and passenger steamers building by Messrs. Mackay Brothers to the order of Messrs. Fry, Miers & Co., for the Lloyd Brazileiro, was launched at Alloa. The vessel has been specially designed to carry her deadweight on a shallow draught, with twin-screw engines by Messrs. Aitchison, Blair & Co., Clydebank, for a 10-knot speed. The dimensions are 235 ft. by 36 ft. by 12 ft. and the vessel is classed with the British Corporation.

Oceania.—On September 10th, Messrs. Alex. Stephen & Sons, Ltd., launched a twin-screw steel steamer of about 5,500 tons, built to the order of Messrs. Fratelli Cosulich, of Trieste, Austria, for the Italian Emigrant Service from Trieste and Naples to North and South America. Her dimensions are 390 ft. by 50 ft. by 34 ft., with twin-screw engines 20½ in. 35 in. and 56 in. diameter by 42 in. stroke, and four large boilers fitted with Howden's system of forced draught. She has been built to Lloyd's 100 A1 class, and also to Austrian Veritas, and has been constructed under the supervision of Mr. Augusto Cosulich. In her design special attention has been paid to the emigrants' accommodation, which comes under the new Italian Emigration laws, and in many respects is far superior to the ordinary third-class accommodation. Messrs. Cosulich have now a large fleet in this trade, and have long experience to draw from, but Messrs. Stephen have been able to introduce various improvements in design and dimensions. She will carry in all about 1230 emigrants divided up in two 'tween decks, and provided with numerous lavatories, bathrooms, recreation rooms, and four separate galleys and bakeries, so that the various customs and prejudices of the different races, Italians, Hungarians, Slavs, Jews, etc., may be catered for. The fittings in these 'tween decks have also been designed with a view to speedy dismantling, in order to make room for the American goods which are carried on the return voyage to Austria. In addition to the emigrants' accommodation, state-rooms have been provided for about 45 first-class and 70 second-class passengers, the apartments for both classes being luxuriously furnished, and provided with saloons, smoke-rooms, lounges, etc., built to special designs furnished by Messrs. Stephen's architect. Special attention has been paid to the ventilation, and numerous electric fans of large capacity have been fitted in all three classes of accommodation. Large refrigerated chambers have also been provided for the carriage of ship's perishable stores. The numerous erections and large deck-houses give her a most imposing appearance, while her white painted hull and fine lines give an impression of speed which the twin-screw engines are expected to fully realize. The vessel was named *Oceania* by Miss Agnes M. Stephen.

LAUNCHES—Irish.

Nerehana.—On August 27th, the latest addition to the fleet of the Tyser Line, Limited, was launched from the Belfast shipyard. The new steamer has been named *Nerehana*, and is the fifth vessel built and engined by Messrs. Workman, Clark & Co., Limited, for the Tyser Line. She is 466 ft. in length, with a gross tonnage of about 6500, and is a sister ship of the *Thakarua*, which left Belfast about four weeks ago. The *Nerehana* has been built under Lloyd's survey to qualify for the highest class in their registry, and is of the shelter deck type with three complete steel decks extending her whole length. Three of the five holds, into which the cargo space is divided, have been insulated and prepared for the carriage of frozen meat cargoes. For the preservation of these cargoes an efficient refrigerating installation is being provided. Access to each of the holds is by large hatchways equipped with steam winches of the most powerful type, together with suitable derricks swung from tables on the masts and from special derrick posts. Accommodation for the ship's officers and engineers and a few passengers is fitted up in a large steel deck-house amidships, with the dining saloon placed in the centre of the vessel at the forward end. The crew's quarters are arranged on the upper deck forward. The propelling machinery consists of two sets of triple expansion engines, fully equipped with all the most modern auxiliary appliances and having steam from four single-ended multitubular boilers working under Howden's system of forced draught. The construction of the vessel has been carried out under the supervision of Messrs. Esplen, Son & Swanston, London, in the interests of the Tyser Line, Limited.

Mantiqueira.—On September 6th, Messrs. Workman, Clark & Co., Ltd., Belfast, successfully launched from their North Yard the fifth steamer built by them for Messrs Lloyd Brazileiro, of Rio de Janeiro. The four vessels previously launched for these owners are intended for their passenger and cargo service on the Brazilian coast and up the Amazon river. The first two of these vessels left Belfast about five weeks ago, while the other two are at present being finished off at the Alexandra Wharf. The *Mantiqueira* is the first of three vessels of a different type from the above, and they are intended for the Company's coasting and river cargo trade. They are specially designed for carrying a maximum amount of cargo on a light draught combined with a high rate of speed. The new steamer is 276 ft. long, 44 ft. 9 in. broad and 17 ft. 6 in. deep, with a gross tonnage of about 2000. As these vessels are intended solely for cargo purposes the two holds into which the hull is divided have been arranged almost entirely free from obstruction, the deck being strengthened and supported by fore and aft girders with steel cylindrical supporting columns placed near the hatch corners. Both of the holds are furnished with two exceptionally large cargo hatches, each of which is equipped with a pair of steam winches of the most powerful type and two strong derricks stepped on tables built round each mast. This cargo gear is capable of dealing most expeditiously with either a heavy or light general cargo. The double bottom below each hold and also the fore and after peaks have been arranged as ballast tanks for trimming purposes. A large steel deck-house amidships contains accommodation for the officers and engineers, the crews' quarters having been arranged in the topgallant forecastle. A small house has been built on one side of the engine and boiler casing to contain the Clayton fire extinguishing and disinfecting machine, branches from which are led to each of the cargo and bunker spaces; couplings are also provided on the fire extinguishing piping, so that hose piping can be connected and led on to another ship or the quay alongside for fire extinguishing purposes. The new steamer will be fitted with all the necessary appliances to ensure her efficiency for the trade for which she is intended. The propelling machinery consists of two sets of triple expansion engines having all the latest improvements, and there is a complete outfit of auxiliary machinery of the most modern type. Steam is supplied by two cylindrical multitubular boilers working under Howden's system of forced draught. The vessel has been built under British Corporation survey for classification in their registry. The designing and construction of the vessel has been carried out under the direction of Dr. A. Rosauro de Almeida, and when the construction of the steamer is completed she will form a valuable addition to the fleet of Lloyd Brazileiro.

TRIAL TRIPS.

Lord Roberts.—On August 22nd, the steamer trawl, *Lord Roberts* (of which we gave particulars in our September issue, page 75), built by Earle's Shipbuilding and Engineering Company, Limited, Hull, to the order of the Yorkshire Steam Fishing Company, Limited, Hull, was taken for her official trial trip. The vessel left Victoria Dock basin on early morning tide and after adjusting compasses, the officials

and visitors boarded her off the Corporation Pier at 9.30 a.m., and proceeded to the measured mile at Sunk Island, where full speed and progressive trials were run. These proved highly satisfactory to all concerned, a mean speed of 11 knots being attained, the engines working smoothly and the boiler developing ample steam pressure. The vessel was then headed for sea, where her steering and seaworthy qualities were fully tested. After a very successful trip the vessel returned in time to be berthed in St. Andrew's Dock on the evening tide. After receiving her fishing gear she was expected to sail for Iceland the following week. The owners were represented by Messrs. J. Watson, W. Roadhouse and Captain S. E. Murlin (who will take command), and the builders by Messrs. J. L. Read and L. Cubley.

Palma.—On August 22nd, the new steel screw steamer *Palma* (of which we gave particulars in our August issue, page 34), launched by Irvine's Shipbuilding and Dry Docks Co., Ltd., and built for Messrs. Elder, Dempster & Co., Liverpool, proceeded to sea on her trial trip. After adjusting the compasses the engines were put full speed ahead, and the vessel proceeded to steam over the measured mile and, after an excellent run, it was ascertained that a speed of 12 knots had been attained. The engines worked smoothly and the vessel gave every satisfaction. Mr. W. L. Roxburgh was present representing the owners, Mr. Urquhart the engine-builders, and Mr. A. S. Purdon the shipbuilders.

Recovery.—To cope with their increased ship-repairing business, Messrs. Furness, Withy & Co., Ltd., West Hartlepool, have purchased and equipped a steamer 127 ft. in length, classed A1 at Lloyd's, with freeboard, having twin screws and especially designed and fitted for salvage, wrecking and towing purposes, and she ought to be a very valuable addition to that Company's numerous fleet. She proceeded on a satisfactory trial trip in Hartlepool Bay on August 22nd. The vessel has been specially strengthened for the heaviest class of work, and has three steam winches, powerful mast and derricks for lifting purposes, and is fitted with a most complete set of diving plant with special diving boats—this diving plant being fitted with electric light and telephone arrangements. The vessel has a powerful electric light installation, with search light and a number of portable electric tools. The fore end of the ship has been specially stiffened, and massive brackets and sheaves for lifting the heaviest weights are fitted. The equipment also comprises four powerful centrifugal pumps with boilers and gear complete, together with a large quantity of other necessary gear suitable for these special operations, and she supplies probably one of the most complete and efficient salvage plants afloat. On a continuous steaming trial the vessel attained a mean speed of 11½ knots. After the trial trip the boat immediately proceeded on active work in salving and removing the wrecks of s.s. *Clavering* and s.s. *Carlo* at the mouth of the Tees, also the s.s. *Enterprize* near Whitby.

Ryhope.—On August 23rd, the screw steamer *Ryhope*, built by the Blyth Shipbuilding Company, Limited, to the order of Messrs. Furness, Withy & Co., Ltd., was taken to sea for trial. This vessel, which measures 244 ft. 6 in. in length with a beam of 34 ft. 6 in., has been constructed under Lloyd's Special Survey to class 100 A1. She is of the raised quarter-deck type having short bridge and topgallant forecastle. The accommodation for captain is provided in the bridge, engineers and officers in side-houses on raised quarter-deck and crew in topgallant forecastle. The *Ryhope* has been fitted with extra large self-trimming hatchways, together with powerful deck machinery of the most modern type (comprising Lynn's steam winches, Cochran donkey boiler, and windlass by Emerson, Walker & Thompson Bros., etc., etc.), for the quick and economical working of vessel and cargo. Triple expansion engines of ample power have been supplied and fitted by Messrs. Richardsons, Westgarth and Co., Ltd. Sunderland, cylinders 19 in., 31 in. and 51 in. by 36 in. stroke, with two single-ended boilers working at 180 lbs. pressure. Messrs. S. T. Taylor & Sons have covered boilers, pipes etc. with their "Tynos" non-conducting material. A large company was on board and on the run over the measured mile a highly satisfactory speed was made, the engines working smoothly throughout. The owners were represented by Mr. R. Thompson and Mr. Thos. Tose, and the builders by Mr. Moffitt, their general manager.

Newmarket.—On August 20th, the twin-screw steamer *Newmarket* (of which we gave particulars in our August issue, page 35), a fast cargo vessel, built to the order of the Great Eastern Railway by Earle's Shipbuilding and Engineering Company, Ltd., Hull, was taken for her official trial. The vessel, being completely finished, equipped and with her full load on board, left the Hull Roads at 5.45 a.m. and proceeded to the measured mile course off Withernsea, where the full speed trials commenced. The mean of six runs over the measured mile gave 14½ (fourteen and a half) knots per hour, being half a knot in excess of the contract requirements. After the completion of these runs the vessel steamed as far north as Whitby High Light, after which she was brought back to the Spurn Lightship, at which point the long distance trial of 120 miles provided for by the contract was completed. During the whole of this run the requisite revolutions were easily maintained, the speed, after being adjusted for the set of tides, was 14½ knots per hour. The engines worked satisfactorily throughout the whole of the trial, and the boilers (which were worked under forced draught with moderate air pressure) gave ample steam. Messrs. Wailes, Dove & Co.'s bitumastic enamel was applied to bunkers, engine-room, tank, fore and after peaks and chain locker, and their bitumastic covering to the tank top in engine-room. The Great Eastern Railway were represented by Captain D. Howard (marine superintendent) and Mr. J. N. Blenkinsop (marine superintendent engineer). The contractors were represented by Mr. F. Somerscales (general manager) and Mr. A. H. Tyacke (assistant manager). The vessel arrived in Hull at 11 p.m., where she received the finishing touches preparatory to delivery at Parkeston, when she will at once commence running in the Company's service between that port and Rotterdam.

Antinous.—On August 31st, the s.s. *Antinous* (of which we gave particulars in our September issue, page 75), built by Messrs. Robt. Thompson & Sons, Ltd., at their Southwick Yard, for Messrs. The Egypt & Levant Steamship Co., Ltd. (Messrs. Alfred Laming & Co., of London, managers), was taken out to sea for her official trial. During construction the hull and machinery have been personally superintended by Mr. Wm. H. Robson, of Cardiff, who, after the trial, on behalf of the owners, expressed himself highly satisfied with the vessel and smooth working of the engines. After the trial the vessel returned to the South Dock, where she will load for Venice.

Baltic Sea.—On August 31st, the steel screw steamer *Baltic Sea*, (of which we gave particulars in our September issue, page 75), built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of W. R. Medhurst, Esq., of London, was taken to sea for her trial trip, which proved highly satisfactory. During the whole of the run everything worked with the greatest smoothness when a speed of 11½ knots was maintained on the run from Hartlepool Heugh to Souter Point. The owner, Mr. W. R. Medhurst and Mr. W. C. Carter, of London (the superintending engineer), both expressed themselves as being highly pleased with the ship and engines. After the trial trip the vessel proceeded to the Tyne under command of Captain John Stephen.

Constantinos Bebis.—The steel screw steamer *Constantinos Bebis* (of which we gave particulars in our September issue, page 75), built by Messrs. Short Bros., Ltd., Sunderland, for Messrs. C. D. Bebis & Fils, Athens, left the Tyne fully laden, for her official trial trip and was in every way satisfactory, an average speed of 10 knots being easily maintained. During construction the hull and machinery have been under the supervision of Messrs. J. J. and H. J. Richards, of Cardiff. Messrs. S. T. Taylor & Sons have covered boilers, pipes, etc., with their "Tynos" non-conducting material.

Competitor.—On September 7th, the steel screw steamer *Competitor* (of which we gave particulars in our August issue, page 34) proceeded on her official loaded trial trip from Hartlepool to Whitby. The vessel has been built by Messrs. Furness, Withy & Co., Ltd., Hartlepool to the order of Messrs. The Eskside Steam Shipping Co., Ltd., Whitby (Messrs. C. Smales & Son, managing owners). The machinery worked very smoothly throughout the trial and has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool. The vessel maintained a speed of 10 knots under loaded conditions and proceeded direct to Genoa under the command of Captain W. W. Milburn. The owners were represented

by Mr. Harold Smales and Captain John Milburn, the shipbuilders by Mr. F. Bolton and the engineers by Mr. G. Urquhart.

Welbury.—On September 9th, the handsome steel screw steamer *Welbury* (of which we gave particulars in our September issue, page 75), built by Messrs. Wm. Gray & Co., Ltd., for Messrs. The Merryweather Shipping Co., Ltd., of West Hartlepool, was taken to sea for her trial trip, when the machinery worked smoothly and well, the average speed of ship was 10 knots, the vessel carrying a full cargo, and entire satisfaction was expressed with the results obtained.

Coleby.—On September 11th, the s.s. *Coleby* (of which we gave particulars in our September issue, page 77), built by Messrs. Ropner & Son of Stockton-on-Tees, made her official trial trip in the Tees Bay. The steamer has been built to the order of Messrs. R. Ropner & Co., of West Hartlepool, and is fitted with the builders' patent improved trunk deck. After a very satisfactory trial trip, during which a speed of over 11 knots was attained, the steamer proceeded to the Tyne to load. The owners were represented by their superintendent, Mr. White, and the builders by Mr. J. R. Garthwaite.

Tuna.—On September 13th, the new steamer *Tuna* (of which we gave particulars in our September issue, page 78), built by Ramage & Ferguson, Ltd., Leith, for Messrs. Cowasjee Dinshaw & Brothers, Aden, ran her loaded trial trip on the Firth of Forth, when a mean speed of over 11 knots was obtained, which is one knot in excess of the guarantee speed. The machinery throughout the day worked in the smoothest manner, and the steamer afterwards sailed for Aden. The vessel has been built under the superintendence of Mr. F. J. Trewent, London.

Turul.—On September 13th, the large steel screw steamer *Turul* (of which we gave particulars in our September issue, page 77), built by Messrs. R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough, for the Hungarian Levant Steamship Co., Ltd., of Budapest, proceeded to sea to complete her official trials in a loaded condition. The results were pronounced entirely satisfactory to all concerned, the vessel registering a speed of over 10 knots during a continuous run extending over six hours.

Sussex Coast.—On September 11th this vessel, which is the fifth steamer Messrs. W. Harkess & Son, Ltd., of Middlesbrough, have built for Messrs. F. H. Powell & Co., of Liverpool, was taken to sea for her official trials in Tees Bay. The engines, which are by Messrs. Blair & Co., Ltd., worked with exceeding smoothness, and a mean speed of 11¾ knots was obtained over the measured mile upon exceptionally light coal consumption. The vessel afterwards proceeded to Rochester to load for Liverpool, and accomplished the distance of 300 miles at an average speed of 11½ knots. The *Sussex Coast* is a vessel of 1000 tons deadweight, built on the shade deck principle, her striking features being her large cubical capacity—about 70 cubic feet per ton of cargo—her low net register tonnage—well under 300 tons—and her very ample deck machinery and electric light arrangements, which enable her to load or discharge a full cargo by day or night in under five hours. She has been built under the supervision of Mr. Wm. Law, of Liverpool, the owner's superintending engineer, and arrived in Liverpool with her first cargo on the 16th inst., catching the fifth tide from leaving Rochester, and making an average speed of just under 11 knots loaded for the trip.

Nanthoron.—On September 17th the handsome steel screw steamer *Nanthoron* (of which we give particulars in this issue), launched by Messrs. Wm. Gray & Co., Ltd., of West Hartlepool, had her trial trip. Her owners are Messrs. Griffiths & Sandy, of Cardiff. Amongst those on board were Captain R. H. Griffiths, Mr. T. Sandey and Mr. Penn, of Cardiff; Mr. N. T. Daniels, M.I.M.E., of Cardiff has superintended the construction of the vessel and her machinery and also witnessed the trial. Captain J. E. Murrell represented the shipbuilders, and Mr. Maurice S. Gibb the enginebuilders. The vessel was in ballast trim and a very successful run along the coast was made, during which the average speed of ship was 11 knots.

S. T. Taylor & Sons have covered boilers, pipes, etc., of the S.S.'s *Acadir*, *Dagenham*, and *Echunga*, with their Tynos non-conducting material.

PARAGRAPHS.

Bordeaux International Exhibition, 1907. The exhibit of Models by Messrs. Swan, Hunter, & Wigham Richardson, Ltd., has been awarded the Grand Prix.

Silver Spray.—On August 17th, there was launched from the yard of Messrs. Rykee & Co., of Rotterdam, a steel screw collier built to the order of Messrs. Tyzack & Branfoot. Her principal dimensions are 230 ft. long, 34 ft. 4 in. broad and with a depth of hold 17 ft. 1 in. She is built on the latest self-trimming practice, and special attention has been paid to the rapid working of coal cargoes, four powerful steam winches and a large Cochrane donkey boiler being fitted. Extra powerful ballast pump will be fitted for rapidly dealing with the large quantity of water ballast for which she has a capacity. A deadweight of 1700 tons is to be carried on a draught of 15 ft., under which conditions a speed of ten knots is anticipated. The machinery is being constructed by Messrs. Wilton's Engineering and Slipway Co., under the inspection of Messrs. Flannery & Gregson, of Rotterdam, London and Liverpool. The engines are triple expansion with cylinders of 17½ in., 28 in. and 45 in. diameter, and a stroke of 36 in. supplied by steam from two large boilers 11 ft. 10 in. long by 10 ft. 3 in. diameter, and having a pressure of 180 lbs. There are to be a winch exhaust tank, steam steering gear, feed filter and all modern accessories.

The Telegraph Steamer "Anglia," which, our readers may remember, was sold in London some time ago to foreign owners and in the course of steaming to Belfast for alterations went ashore and was taken over by the underwriters, then sold for what she would bring, is now in dry dock at Greenock undergoing repairs. These, as may be conceived, formed a very considerable item of cost to equip her for new owners. The *Anglia* is a twin-screw steamer, classed 100 A1 at Lloyd's; length, 449 ft. by 54 ft. 2 in. by 24 ft. 7 in., with cellular double bottom. She was built at Barrow about nine years ago. The engines have each three cylinders 22 in., 35½ in. and 61 in. by 48 in. stroke, with four boilers of a grate area of 320 ft. and heating surface of 10,853 ft. The lower part of the ship's structure is being practically renewed and for the punching and drilling necessary in dry dock, preparing for the replating, pneumatic tools are being largely employed. The work of restoring the hull of the ship is in the hands of the Grangemouth and Greenock Shipbuilding Co. while the repairs and renewals to the machinery are being dealt with by the well-known firm of Kincaid & Co., Greenock. When the ship grounded, the boilers and machinery were displaced and several parts broken by the force of the impact; although the port engine was set up at its forward end for about 6 feet, it was comparatively little damaged, while the sole plate, condenser, columns and cylinders of the starboard engine were broken beyond repair. The main and auxiliary machinery, the two after main boilers, fresh-water tanks and other gear were removed previous to the vessel entering the dry dock. The completion of the repairs is being pushed on rapidly, the vessel having been resold to Messrs. Currie & Co., Melbourne through their London representatives, Messrs. F. J. Trewent and Octavius Steel Co., the negotiations being effected by Messrs. Tamplin & Co., London. The vessel has been renamed the *Itonus* and is to be fitted up for carrying horses from Australia, the double bottom serving for the carriage of fresh water. The vessel is expected to be ready in November.

Institute of Marine Engineers. The session reopens at the premises of the Institute, 58, Romford Road, Stratford, on Monday, Oct. 7th, at eight p.m. when the President is to deliver an address and the adjourned discussion on a paper by Mr. Jas. Shirra (Sydney) is to be resumed. The papers which are arranged to follow on Monday evenings during October, November and December are "Damage to the hulls of vessels" by Mr. Robert Elliott B.Sc. (vice-president, Greenock) "The lubrication of marine turbine machinery," by Mr. A. H. Mather (hon. treasurer); "Damage to the machinery of steamships," by Mr. Robert Elliott, B.Sc. Lectures are to be given on intervening Mondays on "Roller bearings," "Logic," and other subjects, while other evenings are set aside for fuel testing and discussions. Interspersed judiciously with the papers, lectures and more solid matter to lighten the burden of life, the Bohemian concerts, which proved so successful a feature last winter,

and carried pleasant memories, are arranged on the invitation of members of Council once a month on Friday evenings.

Refrigerating Industries.—An International Congress in connection with the various branches of refrigeration is in course of arrangement, to be held at Paris in June, 1908, and promises to be of considerable importance to those more immediately associated with the science and practice of refrigeration, as well as incidentally to the general public, for whom the necessaries of life require, to a great extent, treatment by refrigeration. To many also, this science has made possible the indulgence of an appetite for fruits grown beyond the seas, while to not a few it has been a medium to enable them to gratify their aesthetic tastes by preserving exotic plants and flowers; so that from dealing with the necessaries of life, it reached the luxuries and by a further stretch it has touched the artistic. There are six sections in the programme for the conference, under each of which several papers are to be read. These are: I. Low temperatures and their general effects; II. Refrigerating appliances; III. The application of refrigeration to food; IV. The application of refrigeration to other industries; V. The application of refrigeration in commerce and transport; VI. Legislation. The Conference is under the patronage of M. Ruau, Minister of Agriculture, and of the Minister of Commerce and Industry. The Hon. Presidents are M. Emile Loubet, Ex-President of France, and M. C. De Freycinet, Senator and Ex-Minister. The General President is M. André Lebon, Ex-Minister of Commerce and Ex-Colonial Minister. The Hon. Secretaries for the United Kingdom are Messrs. R. M. Leonard (Hon. Secretary of the Cold Storage and Ice Association) and M. G. Levy-Caen (representative of the Paris, Lyons and Mediterranean Railway). There will be besides the business part of the programme, excursions, fêtes and receptions arranged in connection with the Congress, while special facilities will be given to members and friends by the different travelling agencies. The co-operation of the British engineering societies has been invited, and the attractions set forth in the announcements bid fair to secure very hearty support.

The Engineering and Machinery Exhibition.—The Exhibition of Engineering and Machinery held in 1906 at Olympia was such a marked success that the promoters, in response to a generally expressed wish, have organized another exhibition this year, but on an enlarged scale. On September 19th, this exhibition was opened by Sir Alexander B. W. Kennedy, LL.D., F.R.S., the President of the Institution of Civil Engineers, who, in the course of his address stated that the financial side of the exhibition last year was so successful that the promoters handed over £500 to the funds of the various scientific benevolent institutions. After the formal opening, an inaugural luncheon was served, and amongst those present were Sir Alex. Kennedy, Sir Fortescue Flannery, Sir Wm. Preece, Col. Sir E. Raban, Sir Lloyd Wise, Agent Generals for New South Wales, Queensland, South Australia and Natal; Consul Generals of Columbia, Monaco, Paraguay and Uruguay; Presidents of the Institution of Mechanical Engineers, Civil and Mechanical Engineers Society, Institution of Electrical Engineers and the Society of Engineers in Charge; Prof. Unwin, Mr. W. Noble Twelvetrees, Mr. Alex. Siemens, Mr. John Inglis, Major-General Hutchinson, Dr. Hele Shaw, Prof. Ewing, Prof. Dalby, Prof. Coker, Mr. Edgar Worthington, Capt. Sankey, Mr. J. W. Helps, Mr. E. Dacust, Mr. F. H. Payne, Mr. G. D. Smith, Mr. F. W. Bridges, Mr. J. W. C. Haldane, Mr. A. E. Battle, Mr. W. Duddell, Prof. Henderson, Prof. Robert Smith, Mr. H. D. Searles Wood, Mr. Jas Swinburne and the Editor of the Marine Engineer and Naval Architect. The exhibits are of a most interesting character and among some of the best may be classed the machine tools. The Postmaster-General has been kind enough to send an historical telegraphic exhibit with operators in attendance to explain and display it. This exhibit shows the growth of the whole system of telegraphic communication throughout the world. We strongly advise our readers to visit the exhibition as we are certain it will fully repay them for their trouble.

British Engineering Standards Coded Lists.—Volume V. to be published shortly will contain a very special feature of interest as, in addition to the findings of the Engineering Standards Committee for Marine Material, it will contain a complete comprehensive Marine Code (covering Shipbuilding and repairs in all its branches), compiled by Mr. James Adamson, the well-known Hon. Sec. of the Institute of Marine Engineers, whose great practical experience and well-known ability is a sufficient guarantee of the excellence of the work.

Steam Packing.—As is well known with the advent of high pressure steam special means were required to prevent leakage in the glands, and one of the specialities well known in this connection is that of Messrs. Chaplin's Koh-i-Noor packing put forward for either high or low-pressure steam glands, pumps or for hydraulic purposes. The packings are self-lubricating and retain their elasticity under all circumstances, features which will be certain to commend themselves. They are claimed not to get raw or injured by heat, and will not cut or groove the rods. Many steamship firms use these packings and they are well known in marine work generally, as the references and testimonials given prove, one in particular showing that when used on a voyage in the feed-pump glands, with a run of 25 000 miles, it has stood the test well and there was no leakage whatever. These packings are being shown at the present Olympia Exhibition of Engineering and Machinery. The address of the firm is 12, St. Helen's Place, Bishopsgate, E.C., to where all further reference should be made.

Large Heating Plant for Japanese Works.—An order has been recently placed with Messrs. Davidson & Co., of Belfast, for the complete heating plant to be installed in the new steel works now in course of erection in the north of Japan. The plant, one of the largest of its kind as yet supplied to Japan, includes ten separate heater sets which are to provide heat for two large machine shops, measuring 600 ft. by 130 ft., and 650 ft. by 168 ft. respectively. Each set comprises a large Sirocco Multitubular Air Heater, and an electrically-driven Centrifugal Fan. The air heater consists of a central furnace from which the products of combustion are led through a series of tubes arranged horizontally on either side of same. The current of fresh air passes round the outside of the tubes, and there is no possibility of it becoming vitiated by coming into contact with the flue gases. Owing to the long distance the products of combustion have to travel before they reach the chimney, almost all the heat which can be obtained from the fuel is usefully applied in warming the air current, which makes it possible for these heaters to warm a large volume of air with an exceedingly low fuel consumption. Attached to the heater is an electrically driven Sirocco Centrifugal Fan, which draws the air through the heater and discharges it, warmed to a suitable degree, into the building. With the system of heating which will be installed in the Japanese Steel Works no ductwork is required, which means a considerable reduction in the first cost of a plant of this character, as well as a decided economy of valuable space. Further, the running cost of this system is low, owing to the fact that the fans are not propelling the warm air through ducts, which by setting up resistance to the air currents increase the amount of power required to operate the fans. In addition to the above-mentioned heating plant, the Japanese Steel Works have also ordered from Messrs. Davidson & Co. four Sirocco Induced Draught Fans, 55 in. in diameter, direct coupled to electric motors. These fans are to deal with the flue gases from two batteries of boilers in the same works.

BOARD OF TRADE EXAMINATIONS.

Note.—1C denotes First Class; 2C Second Class.

August 24th, 1907

Aikman, J McL	2C	Leith	Davies, Owen ..	2C Cardiff
Allison, Robt ..	2C	Glasgow	Davis, Eric	2C Cardiff
Annison, R C	2C	N Shields	Deeks, Percy J	2C South'ton
Banks, F S ..	2C	W Hart'l	Dobson, Chas	1C W Hart'l
Beckwith, H J	2C	London	Downie, Russell	1C Glasgow
Biles, Howard	1C	N Shields	Duff, Wm S ..	2C Glasgow
Bishop, Samuel	1C	Liverpool	Dunbar, D G	2C Leith
Blenkey, T H	2C	W Hart'l	Duncan, J H	1C Leith
Buscombe, W E	2C	Cardiff	Evans, Albert E	1C Cardiff
Cave, Henry ..	1C	W Hart'l	Fairweather, H A.	1C London
Charles, George	2C	Glasgow	Forshaw, W D	2C Liverpool
Cooper, Thos	2C	W Hart'l	Gillanders J McB	1C Glasgow
Cormack, P E	1C	Leith	Gollan, Wm ..	1C Liverpool
Cubbin, W S	2C	Liverpool	Graham, John S	2C Glasgow
Currie, Alex H	2C	South'ton		

Part of the Board of Trade Examination Results have been held over for want of space

The Marine Engineer
And Naval Architect.
LONDON, NOVEMBER 1, 1907.

GAS ENGINE INDICATORS.

As gas engines are becoming a consideration for our readers as regards their use in the mercantile marine, we may consider a paper read by Professor Bertram Hopkinson, before the Institution of Mechanical Engineers, upon the indicated power and mechanical efficiency of the gas engine. In the first place, we may point out that there is no indicator at present in use which can be made use of, to accurately indicate a gas engine. Professor Hopkinson deals with this subject in the first part of his paper. He points out that a committee of the Institution of Civil Engineers, having found various degrees of efficiency from the diagrams taken from engines of 5 H.P. to 20 H.P., found that there was a reduced efficiency in the larger engines. On this the conclusion of the committee was that the indicator diagrams were incorrect, and they found a result such as satisfied them by taking the record of the work made whilst the engine was running light, and by adding the power absorbed at no load to the various brake powers. It was found by Professor Hopkinson that any form of pencil indicator could not be relied upon to give a correct indicator card, by reason of the slackness of the joints, and the multiplication of the error at the marking pencil. This error was found to be at least $\frac{1}{100}$ to $\frac{2}{100}$ of an inch, making an error in the diagram of 3 to 5 or 6 per cent., and is even likely to form as much as 10 per cent. error. From these difficulties in the known indicators Professor Hopkinson had to come to the conclusion that it was necessary to reduce very much the motion of the moving parts of an indicator, and to use optical means for magnifying that motion. This resulted in a new form of indicator, in which the pressure from the gas engine was communicated through a piston upon the centre of a straight steel strip held as an encastred beam in a steel frame. The pressure upon the piston deflects the spring, and so tilts a small mirror about an axis at right angles to the bore, the pivots of this mirror being carried on a steel frame. To give the other motion to the mirror the whole apparatus, the straight spring and the mirror with its pivots, is positively connected to an eccentric on the crank axle, by which it is rocked about the axis of the indicator piston, thus giving the piston motion of the diagram without the possibility of any lost motion. This now gives a practicable indicator, by which a telescopic arrangement will project a ray of light upon the mirror, by which it will be reflected as a diagram, which may be photographed if required. It was found with this instrument that by means of excellent tests they were found to have established the accuracy of the instrument. The indicated horse power, however, is dependent upon other things than an accurate indicator. It is found that it is determined by the temperature of the cylinder walls and piston and by the opening of the gas-cock; as, for example, with the same opening of the gas-cock it was found that there was a difference in power absorbed of 4 H.P. for a hot engine (about 180° F.), as compared with 6·5 H.P. when the engine was cold (about 70° F.). It was found also that excess of oil used and water injected made a difference when working cold of 4·7 H.P., and the curious result of 2·7 H.P. as the whole power absorbed. The following result, deduced by the Professor, makes some interesting reading for those who desire to know the facts. In normal working at nearly full load (41·0 I.H.P.), with the jacket at 180° F., the mechanical loss of this engine may be thus allocated:—

Suction	1·4 H.P., or	3·4% of I.H.P.
Piston friction	2·5 „ or	6·1% of „
Other friction (valve lifting, etc.)	1·1 „ or	2·7% of „
Total	5·0 H.P., or	12·2% of I.H.P.

THE "MAURETANIA."

While the world in general has been anxiously awaiting the result of the return voyage of the *Lusitania*, the Tynesiders, in particular, have been deeply interested in the departure of the sister-ship, *Mauretania*, from the home of her birth. It was indeed a sight ever to be remembered which met the gaze of those who travelled down the Tyne on Tuesday afternoon, October 22nd, during the passage of the Cunarder to Liverpool. It may be said at once that the sides of the river were densely packed, and every eminence within the proximity of the river was crowded with eager sightseers, and perhaps the most stirring moment was reached when, near the training ship, manned with boys, rang out, in clear and distinct tones above the many-toned whistles, the National Anthem. While naturally the particular firms engaged in the construction of the ship were deeply nterested in the event, one could not but be struck with the general and enthusiastic interest shown by the population in general, and the impression given appeared in every way to emphasize the proud fact that the Tyne had produced the largest ship yet constructed in the whole world. The builders of the vessel—Messrs. Swan, Hunter & Wigham Richardson, Limited—and the makers of the turbine engines, had jointly invited a brilliant company of ladies and gentlemen to a maiden cruise from the Tyne to Liverpool, round the north of Scotland, and under ideal conditions of weather and the luxurious surroundings of this magnificent vessel (which is nothing more or less than a floating palace) the guests had a most enjoyable and instructive voyage. Even after spending some days on the vessel it is extremely difficult to appreciate her size, as no basis of comparison is available. For example, when in proximity to a 10,000-ton liner, from the deck of the *Mauretania* the liner looks like the size of an ordinary tug-boat. Then again, any one of the twenty-four ventilators along the "sun" deck would suffice for the funnel of a 3,000-ton steamer, whilst the foremast is large enough in diameter to allow the men to go up and down to the crow's-nest, 130 or 140 feet up from the water, by means of a ladder placed within the mast, which is hollow. Every person, of whatever nationality they belong to, cannot but admire the pluck, enterprise and far-seeing policy of the Directors of the Cunard Company in building these magnificent ships, and we have no doubt as time goes on, it will be shown in the future, as it has been proved in the past, that the success of the Atlantic trade has been largely augmented and encouraged by the production of such magnificent steamers, and we wish the company every possible success in their forward policy.

MR. W. J. WILLETT BRUCE, R.N.R.

WITH this issue we have the pleasure of giving the portrait of Mr. W. J. Willett Bruce, R.N.R., a gentleman well known and widely respected and holding the responsible position of Superintendent Engineer of the White Star Line.

Mr. Willett Bruce was born in 1861, and educated at a private academy in Liverpool, where he was specially trained for engineering. His apprenticeship commenced at the original White Star works, but after twelve months there he was transferred to Messrs. George Forrester and Co., Vauxhall Foundry, Liverpool. In 1881 he returned to the service of the White Star Line, and began his useful and distinguished career in the following January as 6th engineer of the first s.s. *Baltic*.

For fourteen years he served as a marine engineer in both the cargo and mail service of the company's pioneer steamers, until he was appointed chief of a more modern class of steamers. He completed his service afloat as chief engineer of the first *Adriatic* (R.M.S.) in July, 1895. In that year Mr. Willett Bruce was chosen out of a large number of applicants as Assistant Superintendent Engineer to the White Star Line. He held this position for nine years, and in 1904 was appointed Superintendent Engineer, in succession to Mr. Horsburgh, to whom he had been a loyal and helpful assistant. The news of his appointment was received with the greatest satisfaction on all sides, and especially by the workmen connected with the company, whose esteem and respect he had won by his just and considerate treatment.

For the past eighteen years he has been a member of the Royal Naval Reserve, passing through the various ranks and now holding the position of Chief Engineer. He has always taken a keen interest in the Royal Naval Reserve, and has been instrumental in inducing a considerable number of engineers in the White Star service to enrol themselves in its ranks.

Mr. W. J. Willett Bruce, R.N.R. *Photo by H. Dowden, Bootle.*

Mr. Willett Bruce's service in the White Star Line has now extended over a period of twenty-six years afloat and ashore. His position is one of great responsibility; not only has he the direction of all services as regards the propelling power, etc., but he has also the management of the extensive White Star works at Bootle, which include all descriptions of work from engineering to electro-plating and japanning.

He is intimately connected with the engineering interest in Liverpool, being a member of Council of the Liverpool Engineering Society. Appreciation of his ability and the long service he has rendered in different departments of engineering has been further shown by his election as President of the Liverpool Marine Engineers and Naval Architects for 1907.

In many cases of exceptional difficulty Mr. Willett Bruce has shown his remarkable power of organization and direction. This was especially the case in the repairing of the *Majestic*. In 1905, while this steamer was busily engaged in the middle of the passenger season, the connecting rod bolts broke and wrecked the starboard intermediate engine. The cylinder and back column and its accessories were destroyed, while both the front column and a portion of the bedplate were very seriously damaged. The repair work was undertaken by Messrs. David Rollo & Sons, under his supervision, on July 11th. The operation involved the casting of a new cylinder weighing 19 tons, the engine column weighing over $10\frac{1}{2}$ tons, and the cylinder lining weighing about $5\frac{1}{2}$ tons, and other heavy parts, making altogether about 45 tons of machinery, and the complete fitting of the new engine on the steamer. By dint of continuous and unceasing work the whole operation was satisfactorily performed in the short period of six and a half weeks, and a trial was made of the new engine under steam in dock on the 26th August. The *Majestic* was thus enabled to sail on the following Wednesday in her regular turn, having only missed a single trip.

THE SCREW PROPELLER.

XV.*

By A. E. SEATON, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

NEARLY every superintendent marine engineer, and probably every manufacturer of marine engines, has at some time or another made experiments with a view of finding the blade surface that gave better results than something previously obtained; and some few have attempted to determine that area from which the best results were possible. Generally, however, such experiments have been forced on the experimenters by stress of circumstance, such as failure to comply with a contract condition, or due to the advantage to be gained by a very slight increase in speed on short voyages where tidal conditions enter as an important factor. Such experiments are necessarily of a tentative nature, and seldom or never of the bold character displayed by the Admiralty when the screws of H.M.S. *Drake* were increased in area of working surface from 76 to 105 sq. ft., or by more than 38 per cent. Nor have the changes made by most private engineers been so great even as those tried in H.M. Navy fifty years ago, when the comparative small-surface screws by Griffiths were proving formidable competitors of the favourite service common screw. The leading corner of the latter was cut away so that the outer leading edge was parallel with the following, and the reduction in area of blade surface thus made was about 15 to 20 per cent. Later on the following corner was treated in a similar way, so that a blade became in form a hexagon and approximate to the Griffiths, but seldom or never so broad in the widest part: consequently these cut-down screws were generally deficient in surface, and therefore often gave worse results than those obtained before the alterations were made.

Then, too, experiments with propellers having a different number of blades incidentally furnished evidence of a sort bearing on the surface question, inasmuch as the difference in surface and areas was generally great. For example, in H.M.S. *Emerald*, a frigate very similar to the *Diadem*, already alluded to in Table XIX., page 438, a two-bladed common screw of 18 feet diameter with a surface of 82·8 sq. ft. was replaced by a six-bladed one of the same diameter, but having a surface 103 sq. ft. A similar experiment was made in another frigate, H.M.S. *Shannon*, when the two-bladed propeller had only 71·2 sq. ft. of surface, while the four-bladed screw had as much as 115·2 sq. ft. and the six-bladed one the huge amount of 172·8 sq. ft. The area of these last two screws was so far in excess of what is now known to be good practice that the results of the trials with them were poor, and they are therefore not so instructive as those of the *Emerald*. As, however, experiments with these two ships will be dealt with later on, when the question of number of blades is discussed, nothing further need be said of them now.

The case of H.M.S. *Iris* is especially worth attention when considering the problem of blade area, as well as the other propeller factors, chiefly because of the care taken over these trials and the full reports of them published and at our service. For this particular purpose a comparison of the performance of the original screw when propelling the ship at 15·12 knots, and the same screw with two of its blades removed when running at 15·726 knots, has been made, inasmuch as both propellers are of the same diameter and have blades of the same shape, the only difference being in the number of blades and, consequent on that, half the surface.

H.M S. *Drake*, like her sister ships in 1902-3, is a first-class cruiser of 14,100 tons displacement, and obtained a speed of a little over 23 knots with 30,557 I.H.P. The Admiralty speed coefficient was only 231, a low one for so large a ship, although a fairly high one for so great a speed. Her original screws for the power, 131 I.H.P. per revolution, had the remarkably small blade surface of 76 sq. ft. each, or 4 ft. less than those of H.M.S. *Carnarvon*, of 10,850 tons displacement, and 21,332 I.H.P. with the speed of 23·3 knots, and only 74 I.H.P. per revolution and a coefficient of 290, and only 4 sq. ft. larger than those successful ones of H.M.S. *Iris*, of 7,500 I.H.P.,

TABLE XXII.

PARTICULARS OF NAVAL SHIPS TRIED WITH DIFFERENT SCREWS.

Name of Ship	DIADEM.	DUNCAN	IRIS	DRAKE	CARNARVON
Designation	Frigate	Line of Battleship.	2nd class Cruiser.	1st class Cruiser.	1st class Cruiser.
Length between perpendiculars ... ft.	240·0	252·0	300·0	500·0	450·0
Breadth Extreme ... do.	48·0	58·0	46·1	71·0	68·5
Draught of Water, mean ... do	20·5	19·85	18·1	26·0	25·0
Displacement ... tons	3800	3985	3290	14100	10850
Wetted Skin ... sq. ft.	16406	18527	18600	45300	34500
Area of Immersed Mid. Section ... do.	750	808	700	1750	1541
Prismatic Coefficient of Displacement ...	0·739	0·685	0·548	0·564	0·534
Speed on Measured Mile ... knots	12·003	13·338	18·587	24·11	23·30
Indicated Horse Power ...	2979	3341	7556	31200	21332
Admiralty Speed Coefficient ...	143·4	176·2	188·0	255·6	290·0
Date of Trial ...	1858	1861	1878	1903	1905
Number of Screws ...	One	One	Two	Two	Two

* For Articles I to XIV see last fourteen issues

or 41 I.H.P. per revolution. The original screws of the *Drake* were replaced, as already stated, by ones of the same diameter and shape, but having a blade surface of 105 sq. ft. and a somewhat less pitch, so that on trial the I.H.P. per revolution was 127. The speed attained now was 24·11 knots with 31,200 I.H.P., and the Admiralty speed co-efficient 256, an improvement in every way on her former performance.

H.M.S. *King Alfred*, a sister ship of the *Drake*, with screws each of the same surface and practically the same pitch as the original ones of the *Drake*, drove her at 23·465 knots with 31,156 I.H.P. when the Admiralty speed coefficient was 242; the same ship attained a speed of 21·98 or practically 22 knots with an I.H.P. of only 22,540 so that the coefficient was as high then as 273 and therefore the performance was very good. Now it may be argued from this, that capability of getting that extra knot on a push may make a vast difference in the result of an action or chase. If it has not already been done, it would be a very valuable addition to the knowledge of our Naval Experts if one of these ships was fitted with screws, each having say 90 square feet of surface, and a set of progressive trials made with the three ships on exactly similar lines. Small differences in surface alone, when the screws are of the same diameter and pitch, and the amount of surface is not absurdly small, to start with, do not seem to make much difference in thrust and consequently in the speed of the ship. It is a pity that so few engineers have ever made experiments on a sufficiently large scale and carried them out with the care that is so necessary to ensure of the results being trustworthy and convincing. Those made with the steamships *Alpha*, *Beta* and *Gamma* set out in

TABLE XXIII.

TRIALS OF SHIPS WITH PROPELLERS DIFFERING IN SURFACE.

NAME OF SHIP.	H.M.S DIADEM.		H.M.S. DUNCAN.		H.M.S. IRIS.		H.M.S. DRAKE	
	1st Trial	2nd Trial	1st Trial	2nd Trial	1st Trial	2nd Trial	1st Trial	2nd Trial
Diameter of Screw ....ft.	18·0	18·0	19·1	19·1	18·6	18·6	19·0	19·0
Pitch do. do. ....ft.	33·5	33·5	27·83	27·83	18·17	18·17	23·0	24·5
Surface of Blades ....sq. ft.	80·0	64·8	115·2	100·0	97·2	48·6	105·0	76·0
No. do. do.	Two	Two	Three	Three	Four	Two	Three	Three
Pitch Ratio..................................	1·861	1·861	1·453	1·453	0·98	0·98	1·210	1·294
Surface do.	0·315	0·257	0·401	0·348	0·360	0·180	0·370	0·268
Revolutions per minute	48·75	53·83	54·0	55·0	82·15	88·89	122·4	116·0
Slip per cent................................	27·43	33·76	10·14	11·99	2·5N	1·99	13·20	17·80
Speed of Ship ....knots	11·661	11·754	13·322	13·289	15·123	15·726	24·11	23·05
Indicated Horse Power	2326	2664	3167	3217	5251	4368	31200	30557
Do. Thrust ....lbs.	47000	48700	69670	69040	116100	88160	365600	354800
Calculated do. .... do.	32200	34820	43890	42700	82520	68370	308200	253100
Resistance of Ship ....lbs.	27200	27620	40700	40500	53240	57400	252940	239638
Augmented Resistance ....do.	5000	7200	3190	2200	29280	16800	55260	13462
Resistance of Ship Horse Power........	974	997	1665	1647	2468	2770	18715	16891
Screw Friction, etc. do. do.	85·5	93·7	170·3	157·3	820	525	2856	1829
Engine and other losses do.	1087·8	1315·7	1200	1318	601	538	5537	11588
Horse Power delivered by Screw	1153	1255	1796	1741	3830	3305	22807	17940
Displacement $^{2/3}$ × Speed^3 ÷ I.H.P...	163·8	148·9	187·6	183·3	145·5	197·0	255·6	231·1
Do. do. ÷ P.H.P..	330	318	331	339	200	261	350	393
Rest'ce H.P. : I.H.P. (Gen'l efficiency)	0·419	0·374	0·526	0·512	0·470	0·635	0·600	0·553
Prop'lr H.P. ÷ I.H.P	0·496	0·471	0·567	0·541	0·730	0·756	0·731	0·587
Do. + Friction H.P. of Screw ÷ I.H.P.	0·533	0·506	0·621	0·590	0·887	0·877	0·823	0·649

notwithstanding the fact that the big surface screws of the *Drake* caused a gain of one knot per hour when running at full power, the original or smaller screws were the better ones for general service purposes and certainly must have been so for speeds under 20 knots, now seeing that it is highly improbable that under service conditions with ordinary bunker coal, a speed of 24 knots will ever be attained by these ships, and that for long chases in war time the 22 knots of the *King Alfred* will be probably the best that circumstances will permit of and, moreover, when cruising and going from station to station, a speed of even 20 knots will never be exceeded except in an extreme emergency, and most of the running done at speeds not exceeding 15 knots, the *King Alfred* may prove as efficient a ship as the *Drake* with her big screws. On the other hand at a critical period in war time, the Table XVIII, page 391, and fully described by Mr. Maginnis in his paper read before the members of the Institution of Naval Architects in 1879, go far to answer the requirements, and all honour therefore, is due to the man who initiated and carried them out. No doubt the owners of these steamers were more than amply repaid the expense they were put to and do not regret the spending of that money, as most shipowners regret, on what after all was only an experiment.

In Table XXIII the *Diadem* was a frigate already fully described on pages 437 8. H.M.S. *Duncan* was one of the last of the fine old wooden Line of Battleships and must have had a goodly shape and remarkably fine lines for her day, seeing that she attained a speed of 13·3 knots with an Admiralty speed coefficient as high as 187·6. Her dimensions, etc., are set out in Table XXII, together with those of the other ships

above mentioned, that the fullest means for making comparisons may be furnished and data put on record which may prove useful at other times than when considering the question of screw surface. Referring to Table XXIII., it will be seen that in the cases of the *Diadem* and *Duncan* a reduction in blade area resulted in a reduction of speed coefficient, although in the case of the *Diadem* the speed itself was actually better. As a matter of fact the screw of this ship should have had a surface not less than 80 square feet in area, so that the original screw was right, while when cut down it was too small; hence the large amount of slip which permitted of the higher I.H.P. to be developed by her engines. In the case of the *Duncan*, her three-bladed screw should have had a surface of about 100 square feet, which is the area of her screw blades after cutting, consequently the results do not differ much and the speed was practically the same, as was also the I.H.P. The extra friction on Engines and propeller due to the higher revolutions in her second trial was no doubt partly set off by the reduction in surface of blades.

The two trials of the "Iris" quoted in Table XXIII. show how vast the difference in results may be with screws differing as these did in surface. Here the removal of two blades cut down the area by 50%, *viz.*, from 97·2 to 48·6 sq. ft. Now for engines each intended to indicate 3800 I.H.P. at 90 revolutions, a screw having 65 sq. ft., with four blades, should have been sufficient, and if with two blades, 45 sq. ft. was enough surface. But for the 2500 I.H.P. at say 80 revolutions, 38·5 sq. ft. would have been sufficient surface for a two-bladed propeller. It will be seen therefore, that the original screw of the "Iris" had far too much surface for the conditions of full speed (18·5 knots), and for the 15·123 knots it was quite inappropriate; also, that the two-bladed one might have been used for full speed trials had the pitch been increased by a suitable amount, while for 15·726 knots, the surface was ample, in fact, too much to give the best results. In spite of this, the efficiency of the reduced propeller is manifest, as may be seen on referring to the speed coefficients—197 as against only 145·5 and by taking only the output of the screws (P.H.P.) as divisors, the same conclusion is indicated by the coefficients 269 and 207. It will be seen in this instance this loss by propeller resistance was 820 I.H.P. with four-bladed screws and 525 with two-bladed, and when both screws were running at practically the same revolutions, *viz.*, 82·15 and 81·2, the loss was found to be 820 and 400, or that of the four-bladed was rather more than double the friction loss of the two-bladed.

It will be seen that the mechanical efficiency of the engines of the "Iris" must have been very high, and the figures verify the calculations made by Sir James Wright, based on the diagrams taken of them when running "light" and disconnected from the propeller. The contrast between their efficiency and that of the machinery in the old wooden ships is most marked, and shows that the losses were enormous with these old horizontal engines having a set of big air pumps, feed and bilge pumps, etc., laid on a wooden bed in a comparatively weak wooden ship.

The Mauretania is having her bottom coated with Holzapfel's International Composition, in the dry dock at Liverpool.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Carriage of Petroleum Spirit.

THE loss of the steam tanker *Silverlip* in the Bay of Biscay on the 1st May, 1907, was an incident which appeals strongly to all those who are concerned with the question of navigation, for with oil fuel in use in warships, we may soon find passenger steamers using liquid fuel. Here was one of the finest and newest vessels of her type, built by one of the most eminent shipbuilding companies in the country and owned and managed by a firm of high standing in the city of London. Yet destruction came upon her in an instant of time with considerable loss of life and personal injury, whilst, but for the fact that her master, Captain Hocken, showed great presence of mind and the bravery which is characteristic of the British seaman, there is little doubt that even more deplorable consequences would have ensued. From the evidence laid before the Court of Inquiry it appears that the owners of the *Silverlip* have carried upwards of three-quarters of a million tons of this petroleum spirit without any previous accident, save the burning of a small lighter some five years ago. Yet it seems pretty obvious that there are lessons to be learnt from the loss of the *Silverlip* which may tend to minimise the risk of those who navigate such vessels in future. A difficulty is introduced into the construction of these ships by the circumstance that, owing to the requirements of the trade, they have to be built so as to be capable of being used alternatively as tankers or as general ships. For carriage of oil in bulk it is desirable that the tanks have small openings. But for general work they must have large cargo hatches. Every care is taken to close these efficiently when oil is being shifted. But the joints are so long that it seems very probable that—especially when the ship works in a seaway—there would be some leakage of spirit. By this means it is thought by the Court that an accumulation of vapour was formed in the 'tween decks. Accordingly suggestions are made as to possible improvements in the method of sealing the hatches or of carrying them up to an upper deck, and as to a way for ventilating the tanks by pipes carried high up the foremast and well away from anywhere members of the crew could interfere with the vapour. For there seems to have been little doubt in the minds of the members of the Court that it was the smoking of a couple of firemen under the bridge deck, or even in the carpenter's shop, that ignited the accumulated vapour, the unfortunate fact being that as smoking was necessarily most strictly prohibited, those who intended to infringe the rule would, by their desire to escape observation, be driven to seek enclosed places where the danger of ignition is greater in inverse proportion as the risk of detection is less. The Court suggest that rules should be made empowering the officers to search any members of the crew at any time for matches the possession of which it thinks ought to be forbidden to all private persons on board—though a supply for ship's use might be kept under proper safeguards. These suggestions are useful in their way, and may tend to minimise the danger. But from the experience with miners—who will open their safety lamps in coal mines where fire damp is known to be present, and thus risk their lives and those of their fellow-workers for a smoke—it is certain that no precautions will ever entirely abolish the danger.

An American Yachting Tour.

Colonel Robert M. Thompson, late of the United States Army, a gentleman who is now a financier, but who has in his time played many parts, is apparently about to make a tour of the world on lines which are strongly reminiscent of the famous yachting scheme of Mr. Wells, of Monte Carlo fame. Mr. Wells, it may be remembered, purchased a staunch old ship of the Alfred Holt line, and having practically gutted her, fitted her up with luxurious accommodation including one huge chamber which could be used as either a ball room or music-room. But circumstances over which he had no control intervened, and other engagements took Mr. Wells elsewhere. So the *Palais Royal*, as he called his yacht, was not completed for sea during his possession of her though she subsequently went cruising as the property of a certain foreign nobleman. Colonel Thompson has now made up

his mind to take a party of guests round the world under conditions of considerable luxury. He has chartered from the Hogan line of Bristol their steamship *Mineola*, a vessel of some 4700 tons gross register, built seven years ago at Sunderland. She has hitherto been employed as a cargo vessel on the Rotterdam and Galveston route. She is to be changed internally in many important respects. A ballroom 100 ft. long and fully 50 ft. wide is to be introduced, whilst some fifteen *suites de luxe* are to be provided for the use of his guests. These rooms are to have the fittings of the most luxurious of modern Atlantic liners, including bedsteads, bath-rooms and telephones—though why telephones should be needful in a ship of moderate size, where passengers are few, seems to want explaining. Altogether the alterations to the ship will cost some fifteen thousand pounds. They are to be completed in time for her to get to sea by the 1st December and the trip is to take a year and a half. It sounds attractive on paper, but in practice one would imagine that a year and a half with an American millionaire would be somewhat tedious.

The "Lusitania."

On her second trip to the westward the new Cunarder has captured the Atlantic record. She ran down to Queenstown in ten hours, thus making her voyage in these tidal waters at about 24 knots speed. Leaving the Irish port at 10.25 a.m. on Sunday, the 6th October, she ran 41 miles to noon on that day; to noon on the Monday she covered 590 miles; to noon on the Tuesday her run was 608 miles; and by this achievement she obtained the record for a day's steaming; to noon on the Wednesday she did 617 miles, thus considerably improving on her own performance; to noon on Thursday she ran 600 miles, and at 1.17 a.m. on Friday was off Sandy Hook, having done 324 miles since mid-day. Her total distance was thus 2780 miles and her mean speed 23·993 miles. It will be seen that she improved her daily runs as she went along, until at last she struck fog and had to slow somewhat. But nevertheless she beat her own maiden trip by about five hours, and exceeded the mean speed of the *Deutschland* by about three-quarters of a knot. She has also by her 617 miles for a day's steaming surpassed the solitary and doubtful achievement of the German steamer by no less than 15 miles, reaching a speed of 24·76 knots, though slowed for a part of the day on account of fog. But she will do better as time goes on, for it is evident that conditions were far from favourable—one racer, which was at sea about the same time as she, falling some two knots behind her usual speed, and others reporting that they had had very bad weather. It seems pretty certain, therefore, that ere long the new Cunarder will fulfil the guarantee and do her 24½ knots.

The old Allan Liner "Bavarian"

is indeed an unlucky ship. After stranding in the St. Lawrence in the month of November, 1905, she was caught by the ice before her salvage could be completed, and she had to endure a winter of exposure to the inhospitable conditions of a Canadian winter. But with the spring operations were renewed, and just about a year after her original accident she was got afloat. By this time she had ceased to be the property of her old owners. Close examination brought experts to the opinion that she was not worth repairing, and she was accordingly handed over to her salvors, who, taking a more hopeful view of the case, set busily to work to prepare her for a voyage to Halifax, where she might be restored to efficiency. On the 17th September they believed that she was ready to be floated from the position where she had been beached for temporary repairs. But after she had proceeded a short distance it became necessary to put her on the hard again. During the brief time she was afloat, however, she seems to have been in bad luck again. For it is alleged that she was in collision with a passing steamship, the *Carrigan Head*, of Belfast, outward bound from Quebec to Dublin. In respect of this collision a claim for no less than £2000 damages has been made, whilst, to crown all it is said that in a gale on the 28th September she shifted her position and broke her back. This latter report, however, seems to want confirmation—but the chapter of accidents is a sufficiently lengthy one without this final catastrophe.

Another ill-fated ship

is the Italian liner *Principessa Yolanda*, which seems to have begun and ended her career on the 22nd September at Genoa. She was the largest mercantile vessel ever built in an Italian yard, and was intended for the fleet of the Italiana Generale Navigazione. Her length being 486 ft. with 49 ft. beam, she had a displacement of 10,500 tons at load draught and engines of 10,000 h.p. This is, of course, a vessel of considerable size and, for some reason, as yet undisclosed, she was fitted with all her machinery, even with her funnels and masts whilst she was still on the stocks, her launching weight being 7200 tons. Further, she was built at an unusual distance from the water, and thus her journey down the ways was one of exceptional length. Everything, as it will be seen, contributed to make her launch a ticklish one, and to put a great strain on the gear. This strain it does not seem to have been able to withstand. As the vessel went towards the water the cradle burst, and the hulk took a list. Her ports being open, enough water entered to prevent her righting herself and she sank. She lies in some sixty feet of water flat on her beam ends. Loss of life seems to have been avoided, owing—as the report states—to the presence of mind of the captain and the boatswain. Here, again, is a remarkable fact, for one can hardly imagine a British ship being launched with her officers in charge of her. Moreover, it is said that when the divers went down they found some of her contents—amongst them were particularly enumerated kitchen utensils and bedding—lying alongside, so that the vessel seems to have had almost all her weights aboard. It is said that the wreck will have to be abandoned. The loss is put at a quarter of a million sterling, for the vessel was a high-class passenger ship designed to effect a considerable reduction in the time of passage between Italian ports and the Argentine. She was to do her 18½ knots and had been furnished in her saloons by the London firm of Waring and Gillow, whilst she had the latest appliances in the way of passenger-lifts and water-tight doors.

The Hamburg American Line

has sustained a serious loss by the sinking in 100 ft. of water of their steamship *Borussia*, homeward bound from the Brazils, whilst coaling in the river at Lisbon. The accident seems to have been a repetition of the *Austral* disaster. The *Borussia* was a twin-screw liner of 6951 tons gross register, built at Kiel in 1905. She was specially fitted for use as an Imperial troopship. At the time of her loss she had coffee to the value of no less than £200,000 on board.

The Progress of Argentina

appears to have fired the steamship companies of many nations. The British West India Royal Mail Company, as we know, has built its new "A" vessels for this trade, partly as a reply to the Nord Deutscher Lloyd, which had put the vessels of the *Zeiten* class on to the station. Italy, as we have just seen, is making her effort to retain her hold of the trade, and now Holland intends to make her bid for the share of the good things to be obtained. The Dutch line to Brazil and the Argentine is to have a subvention of a quarter of a million sterling. Those who support the project of State assistance to the line urged reasonably enough that it would be to the interest of the Netherlands to have direct communication with the River Plate by a home line, "which would be free from all foreign influence." But on the other hand, certain politicians opposed the suggestion on the ground that to aid the Dutch line would be an act of disloyalty to the foreign lines which brought prosperity to Dutch ports. The use of the word "loyalty" in this connection is strange enough. But it is worthy of record, inasmuch as it seems to show that Britain has no monopoly of that modern type of person who strives to encourage the foreigner and to discourage home industries.

New Steamships.

The 1st December is to see the inauguration of the new service of the Egyptian Mail Steamship Company between Marseilles and Alexandria, with the turbine vessels *Heliopolis* and *Cairo*. Hitherto under the British flag passengers to Egypt have either been obliged to travel in the small mail boats *Osiris* and *Isis* of the P. & O. Company—which, though they admirably fulfil their primary purpose of mail carriers, are not quite up to the present standard of comfort for passengers—or have had to take passage in vessels bound through the Canal. In such ships as these latter short-distance passengers are apt to feel to some extent intruders on those who are making the vessel their home for weeks, and to that extent the new steamers will supply a want.

quite apart from the fact that, though of the size of the *Campania*, they have the luxury of a *Lusitania*.

The Canadian Pacific has now obtained the sanction of its shareholders for the construction of the two larger and faster *Empresses* for their Atlantic service. This company has just sold to Japanese owners the old favourites, *Athenian* and *Tartar*, formerly of the Union line to the Cape, and for the last ten years employed on the Vancouver, Yokohama, Hong Kong route.

We now have been definitely informed by Herr Ballin that the Hamburg-American Company does not intend to contest further the Atlantic race. He recognises that greater speed than that of the new Cunarders is not at present a commercial possibility, and he is content, as I felt sure he would be, to leave their achievements as a high-water mark for the time. But he is about to give them his reply nevertheless. This, however, will take the form of a greatly improved and magnified *Amerika*. The tonnage of the new vessel—which it is said is already ordered—is given at 47,000 tons. But this may not improbably be displacement tonnage not gross register. Similarly the White Star Line will follow the type of the *Adriatic*, giving luxury and low speed. Further, it seems definitely fixed that the White Star ship shall have a combined installation of reciprocating and turbine engines, and probably the German ship will be similarly equipped. *Adriatics* and *Amerikas* have not the high speed which gives the turbine a fair field for showing its superiority over the older type of machinery.

Old Steamships.

Want of space during the last month or two has precluded me from noting the disappearance of one or two old friends from the fleets.

The old White Star Liner *Gaelic*, which for the last year or two has sailed under the Pacific Steam Navigation Co.'s flag as the *Callao*, has now again changed hands, passing this time into the hands of the ship breakers. The Pacific Steam Navigation Co. having obtained delivery of so many of its new fleet, had no further use for her, and she is really of an obsolete type, having been fitted with the old tandem compound engine which was so much favoured at Queen's Island in the pre-triple expansion engine days.

Another old favourite has changed hands. This is the *La Plata* of the West Indian Royal Mail Company. Her services have been dispensed with for reasons similar to those which led the P.S.N. Co. to part with the *Callao*. Under the name of *Moor* the *La Plata* achieved a considerable reputation five and twenty years ago in the fleet of the old Union Company as a speedy and comfortable mail steamer. About ten years ago she was lengthened and overhauled at a considerable outlay. But a few years later she was sold out of that service and has since been known as the *La Plata*—a name which has been kept alive in the Royal Mail Co.'s fleet for pretty well half a century. This vessel's predecessor in title was sold when quite a new ship to the Booth Steamship Company. The previous holder of the name became a public yacht, whilst before that there was a wooden paddler as *La Plata*, which was originally built for the Cunard line and purchased on the stocks by the Royal Mail Company to replace a lost ship.

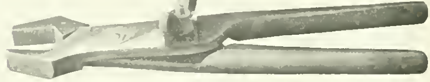
An accident which may prove the end of her career has befallen the steamship *Milan*, of Hull, one of the oldest iron vessels in the British mercantile marine. When leaving the Alexandra Dock, Hull, on her usual voyage to Rotterdam the old craft struck the lock entrance and sustained such damage as caused her to sink. She has, I believe, been raised. But it is, of course, a question whether she will be considered worth sending to sea again. She is a vessel of 1359 tons gross register, built at Port Glasgow by J. Reid in the year 1855.

The Arrangement

between Messrs. Brocklebank's, of Liverpool, and Messrs. Jenkin's Shire line has caused several of the latter's ships to be no longer needed for the purposes of their fleet. Thus the *Radnorshire*, built in 1890 by Messrs. C. S. Swan and Hunter, has been sold and renamed *Assimacos*, whilst the *Merionethshire*, built in 1895 by the Sunderland Shipbuilding Company, was offered by Messrs. C. W. Kellock & Co. at Liverpool on the 17th October, but at auction, the reserve price put upon the vessel not being reached, she was withdrawn.

THE "QUICK GRIP" LOCK-JOINT SPANNER.

Among the various exhibits at the Olympia Exhibition, we noticed on Messrs. A.G. Taylor & Co.'s stand a little tool which should prove useful both in machine shops ashore and those on board vessels, and may even take a place in the engine-room itself for use with the numerous details that are found now-a-days so necessary there. As our illustration shows, this useful article is of almost universal application, between certain limits in the sizes of nuts, where such a tool is likely to commend itself at all. The one shown has a range of from $\frac{3}{8}''$ to $1\frac{1}{4}''$, the locking joint being for heavier work and where a tight nut has to be negotiated. In ordinary cases, however, the grip of the hand is sufficient to give all the holding power



required, as the leverage is so great; moreover, the grip on the nut is of a most effective character. It does really hold its work, but the power to change so readily from one size of nut to another is its special point. We have tried the spanner for ourselves, and can testify to its effectiveness; and, with its further claim to handle rods and pipes, it should prove useful for nuts where the corners are worn off—a frequent case and one in which we know the ordinary spanner is not very effective. We have mentioned some of the points of this simple tool, and others will readily suggest themselves to our readers. It only remains to say the spanner is sold at a low figure, and the makers' address is 17, Poland Street, London, W., to whom further reference should be made.

Fire Protection of Shanghai.—For seaport and riverside towns, floating steam fire engines form most adequate and powerful means of coping with large conflagrations. The Shanghai Harbour Board has had a Merryweather fire float in service for the past six years, and in view of the enormous shipping and property at risk, is putting a second vessel of this description into service. The hull is being built at Shanghai, and the entire machinery for fitting up on board has been constructed by Messrs. Merryweather & Sons, of London, and has just been shipped to its destination. It includes a quick steaming boiler of fire-engine type, a double-cylinder vertical propelling engine, with single screw, to give a speed of 9 to 10 knots, and a powerful double-cylinder fire pump of the firm's patent Admiralty "Greenwich" pattern, capable of delivering 1,500 gallons per minute, discharging through a monitor in one large stream, or through two delivery heads, each with three outlets, in the event of a number of jets being required. Arrangements are also made whereby the pump can be employed for salvage operations. Feed pump, feed heater, donkey pump and all necessary piping for connecting the various parts of the machinery, are also included all complete and ready for fitting up on board. The boiler can raise steam to working pressure in about ten minutes from cold water, but this time will be lessened by the employment of a boiler heater, by means of which the water in the boiler will always be kept hot. The vessel should prove a valuable asset to Shanghai's fire-fighting plant.

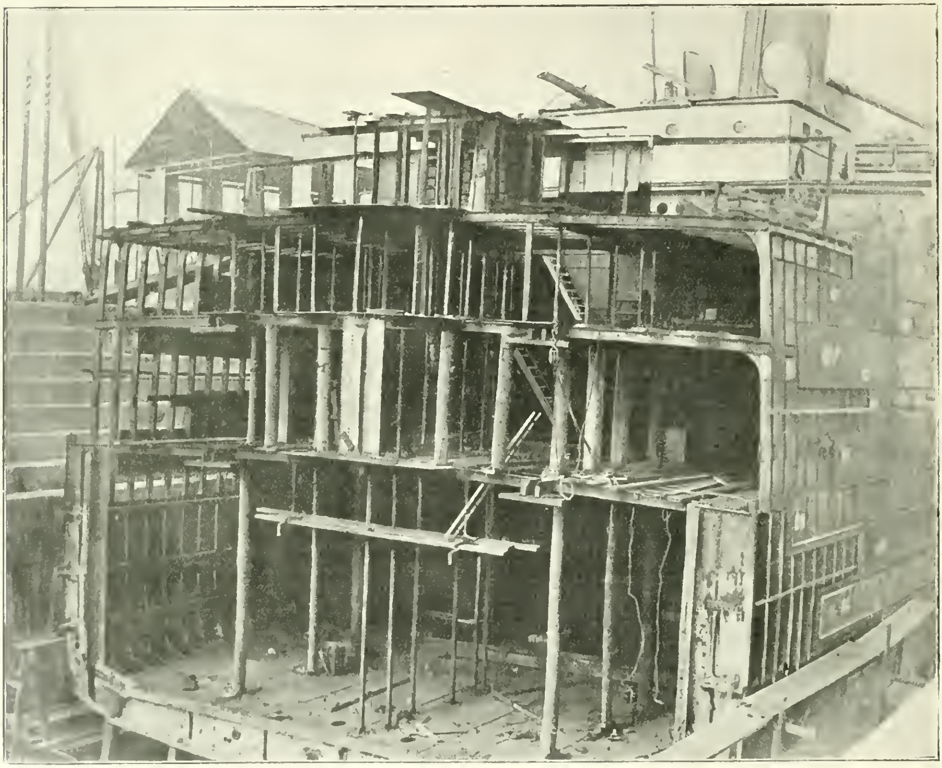
THE SALVAGE OF THE TWIN-SCREW WHITE STAR LINER "SUEVIC."

BY the time these lines are in print an unique feat in salvage and shipbuilding combined will have been almost completed in connection with the above vessel, and in the present short article we purpose giving a description, illustrated by actual photographs of this work, showing the magnitude of the task which faced the Salvage Association and the shipbuilders.

The photographs cover the period from the stranding of the vessel to the arrival of the new bow at Southampton.

The *Suevic*, a twin-screw steamer of 12,500 tons, was one of five vessels specially designed and built for the White Star Australian trade by Messrs. Harland & Wolff, of Belfast. She was 550·2 ft. long, [illegible] ft. beam, and [illegible] ft. deep. The other four vessels were the *Afric*, *Medic*, *Persic* and *Runic*. The *Suevic* was originally launched at Belfast on the 8th December, 1900.

On her last homeward voyage the *Suevic* ran ashore on the Stag Rock at the Lizard, on the Cornish coast. This occurred on the 17th March last during a dense fog. As is well known, the Stag Rock is one of the most, if not *the* most, dangerous place round the British Isles, and it was considered by the majority of experts that the vessel would be a total loss. Our photograph shows the position the vessel was then in, from which her serious position will be easily gathered.



After-portion of the "Suevic" in the Trafalgar Dock, Southampton.

The forward portion was immovably wedged on the rocks, but after examination by the owners and builders, together with the Liverpool Salvage Association, it was decided to commence salvage operations with a view of salving the greater portion of the vessel, and, to effect this, to sever the two portions by the aid of dynamite and gelignite.

Our second photograph distinctly shows where it was decided to sever the vessel, and is marked at the spot thus X X. The work of severing this portion was

successfully accomplished, and the after-portion, containing the engines and boilers, was drawn clear of the rocks, this being accomplished on the 2nd April, the vessel's engines assisting the tugs by running full speed astern. The portion marked A A was left on the rocks, and has now completely vanished.

The salved after-portion was immediately taken in tow by the tugs and headed for Southampton, the vessel's engines materially assisting the steering by means of the twin screws.

The precision with which the severing operation was performed may be gathered from the photographs, and in some places the plates seemed as though cut through with a chisel, so accurately was this work done.

The after-portion was towed safely into Southampton and berthed alongside the quay, and her condition on arrival can be clearly seen from the photograph, which gives a good idea of the work of the dynamite. Hundreds of people thronged the quay to witness the unique spectacle. It will be clearly seen that the vessel was severed just forward of the mainmast. The upper deck can be seen overlapping the 'tween-deck space, and the brine grids for the brine circulation can be clearly distinguished hanging in bunches below it.

After clearing away the *débris* and removing the cargo the vessel was dry-docked for survey, and her appearance at this stage will be seen from the photograph. The ballast tanks for a few bays were filled with cement, and the vessel was then undocked and taken to a berth at the Test Quay, where the work of preparing the above-water portion to receive the new bow was vigorously pushed forward. This work being completed, the vessel was again dry-docked in the Trafalgar Dock and work commenced on the underwater portion.

Our next photograph shows the vessel as she appeared on the 4th October, and nearly ready to receive the new bow portion. As will be seen, the shell plates have been removed to abaft the mainmast, which has also been removed.

The Co_2 condenser can be clearly seen on the upper deck; also, on the left, may be seen the end of the new repairing shops which are being built by the Waring-White Building Company for Messrs. Harland and Wolff.

The Salvage of the Twin-Screw White Star Liner, "Suevic."

The new bow portion was successfully launched by Messrs. Harland & Wolff on the 5th October This portion extends from the stem to the bulkhead aft of the No. 3 hold *i.e.* the fourth bulkhead from the stem, and has a total length of about 212 feet. It is complete with deck-houses, captain's bridge, mast, etc. After being fitted with boats and the necessary appliances, it was towed round to Southampton, there to be joined to the after-portion in dry-dock.

We believe this is the first case on record of such magnitude where such a feat in salvage and shipbuilding combined has been successfully accomplished.

PITTLER'S UNIVERSAL ROTARY MACHINES.

It can be reasonably presumed that few mechanical engineers of ordinary ingenuity have not at some time or other in their career studied the problem of producing a valveless reversible rotary engine, and

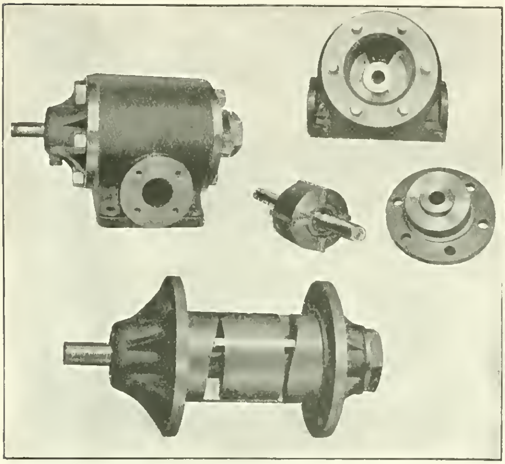


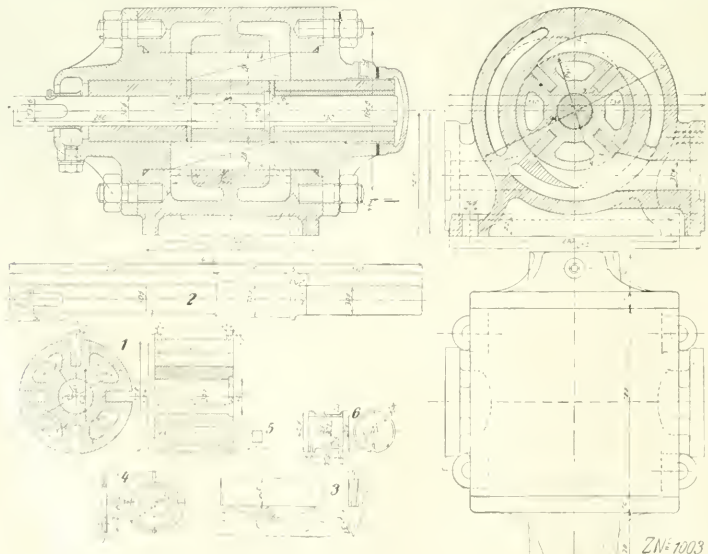
Fig. 1

probably the majority have been certain in their minds that, even if success did not crown their efforts, the time would surely come when the problem would be solved. It may be laid down as definite premises to work upon that the motion must be purely rotary in the direction of the flow of the steam or other fluid, the turning effort must be constant throughout the revolution, it must be capable of unlimited speed variation, it must have no parts moving in any direction except the direction of rotation during the time that pressure is upon them; and, lastly, it must be reversible and, if possible, valveless, self-contained and simple in construction.

At the Engineering Exhibition held at Olympia last month one of the most, if not the most, interesting exhibit was the Pittler Universal Rotary Machine, which, without alteration of parts, works equally well and efficiently as a steam engine, hydraulic pump, water meter, air compressor, air motor, vacuum pump, and other similar purposes.

It is, of course, admitted that in the matter of rotary motors partial success has been attained in various directions, such as the water turbine, which ousted the over and under-shot water-wheels, and the Parsons' Steam Turbine, which is fast displacing the steam engine; but neither of these is reversible, and they will only work satisfactorily within small limits of speed variation, and in conjunction with the steam turbine it is essential for success to have a good and efficient condensing plant. The sphere of usefulness of the last-mentioned rotary machines is very limited; not so with the Pittler Universal Machine.

The inventor is the world-renowned Wilhelm von Pittler, the inventor of many important and



Sectional Elevation and Plan Fig 2

commercially successful inventions, and he is best known by the monumental work he has done in machine-tool design, notably the Pittler Universal Lathe. It is greatly due to his efforts in this direction that the engineering world is enabled to produce the magnificent reproduction work it does.

We are enabled to give our readers the advantage of some illustrations of this machine, which will make the description quite clear, both as to the form of construction and method of working.

Fig. 1 shows a perspective view of the complete machine and the various parts separated from each other.

Fig. 2 shows the parts in sectional elevation and plan as a working drawing.

The machine consists generally of five essential parts, *viz.*, an outer casing, a drum mounted on a shaft, two end plates forming the bearings, and the vanes on which the fluid pressure is impressed. The outer casing is bored, and then ground to exact size; it has two ports, an inlet and an outlet, which are used alternatively for the purpose of reversing the direction of motion. The drum and shaft are turned and ground to size—the drum to a sliding fitted in the casing, the shaft to the long end bearings. Four grooves are milled into the drum exactly 90 degrees apart; into these grooves vanes somewhat longer than the drum are fitted, so as to slide evenly and smoothly in two directions parallel to the shaft; this axial movement is given to the vanes by the specially constructed end plates, upon which they bear slightly during their revolution. The inside faces of the two end plates are made exactly in duplicate, and are composed of two flat and two curved or screw planes connecting the higher and lower-placed flat planes. The end plates are so fixed that the higher flat planes of the one are exactly opposite to lower flat planes of the other, and the screw planes exactly opposite to each other. The vanes being made to a sliding fit between the end plates, it follows that they, being guided by the planes of the end plates, will slide into opposite positions each portion of a revolution the vanes come between the screw planes. It must be particularly noted that no sliding movement of the vanes takes place during the portion of the revolution that they are between the flat planes, or otherwise during the time that pressure is upon them; the vanes being set at 90 degrees, and pressure being on two opposite ones at the same time, prevents any dead point, and provides a constant turning moment in either direction. There is an entire absence of shock, inasmuch as the flow of fluid, steam or air is constant in the direction of rotation. The displacement and sliding movement of the vanes are exactly balanced, and during the period the vanes are sliding they are in equilibrium, consequently no appreciable wear can take place. To secure this immobility of the vanes during the time that work is upon them has been the crucial difficulty previous inventors have had to contend with, and which they have failed to succeed in overcoming. Inasmuch as Pittler, by means of his invention, has secured this immobility, he has succeeded where all other engineers have failed in this respect.

The device is being handled in this country by the Pittler Universal Rotary Machine Syndicate of 81, High Holborn, London, W.C., and we feel sure that the engineering world will watch with much interest the development and progress of this invention, as it promises to have quite a revolutionary effect in many directions.

BYE-PRODUCTS OF THE ENGINE ROOM.

The vexed question of sanitation aboard ship is coming more and more into prominence, for most certainly the subject merits greater attention than it has formerly received, and improvements have been undoubtedly effected within the past few years that give hope for the future; further, there is the more practical side, from the owner's point of view, for even the bilges have been forced to yield profits from what was heretofore a wastage.

Some time ago a firm sent round enquiries directed to the purchase of the grease that was scraped from the tank tops, and although the profit to be made did not appear to warrant them offering a high price, it directed attention to a more economical method of utilizing this waste, the system adopted resolving itself into a means whereby the outflow of oil from the bearings was collected and used again, and if the product be somewhat unrefined, it is, and has been proved to be, sufficiently good for tunnel blocks, pump gear and other small parts about the main engines, besides all the auxiliaries, winches and other oil-consuming dependents, quite sufficiently numerous to utilize all that may be recovered on the average running.

In the first place all the crank pits and other open spaces on the tank tops where the refuse collects are made watertight, the whole leading to a basin formed in some convenient position in the engine-room, from which the drainings may be pumped up to the level of the floors into a tank to allow the grease and water to separate the grease floating on the surface, the water can either be drained or syphoned off, this being the over-wash from eccentric troughs and from leaking glands.

This heavy scumming is now steamed by introducing a small live steam jet—an auxiliary drain cock with a copper pipe attachment serves the purpose—and allowing it to remain in till the fluidity is sufficient to pass the grease through a wire gauze strainer into a drum or tank, any foreign matter held in suspension remaining on the gauze.

The partially purified material exists now in the form of an emulsion and is pumped into a long cylindrical boiler standing vertically, and passing in at the base is forced upwards through a second wire gauze strainer until the boiler is about three-fourths full. The heating arrangement for this vat consists of a steam coil, three or four coils of small copper piping, the one end connected with a cock on a steam pipe the other end with a cock on an exhaust pipe; the coil is placed below the strainer and a door at the foot of the apparatus allows of access to it and also serves for cleaning purposes. A gauge glass is fitted to regulate the amount pumped in and a cock to draw off the water that separates out from the boiling mixture.

Steam having been turned on, the contents of the vat are left, for fifteen minutes or so, till they overflow at the open end of the cylinder into a large bag, made from filter cloth which is tied round this open end and allows the hot oil to drip into a collecting tank, whence, after cooling, it is transferred to the oil-can ready for use.

The process may seem somewhat tedious, but if regularity be observed sufficient can be made each watch; the labour is not great and unskilled labour it is, provided the appliances are complete and kept in good order, the lubricating value of the product is sufficiently good for all such purposes as have been mentioned and the initial cost of the apparatus is soon covered by the saving in oil effected, not to mention the improved sanitary condition of the engine-room.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

THE preparations for the commencement of the St. Vincent (as our new battleship is to be named) are proceeding apace. The plans have been received, the work of laying off begun, and the keel plate is to be laid early in November, probably on the 1st. It is understood that the displacement of the new ship will be about 700 tons greater than that of her predecessor on the slips, the *Bellerophon*, and she is to be completed in two years. The greater part of the side armour of the *Bellerophon* has been fixed, and that battleship was taken out of No. 15 Dock on October 10 and placed under the 100-ton sheers to receive the heavy weights in connection with her turret plating. Some smart work was done while the vessel was in dry dock having her side armour placed. On one occasion five plates, each weighing from fifteen to twenty tons, were fixed to the ship's sides in three hours and ten minutes. This is believed to be a record. The *Dreadnought* was placed in the vacant dock and her rudders unshipped for examination. As each of the two rudders weighs nearly twenty tons, it must be admitted that the time occupied in the work—under eight hours—was a creditable performance, the more so as there was a perfect deluge of rain during the afternoon, which, of course, impeded the men. New propellors are also being put on, and the work on the vessel is to be completed by the end of October. Three vessels have recently left which have been undergoing refits. The steam repair ship *Assistance* left at the end of September to rejoin the Channel Fleet. The *Good Hope* flagship of Rear-Admiral Sir Percy Scott left on October 1 to join the First Cruiser Squadron; and the *Euryalus*, flagship of Rear-Admiral Inglefield, commanding the Fourth Cruiser Squadron, left on October 3. The latter vessel had been here three weeks, and it was essential that she should be got ready by the 3rd as the squadron started on a cruise on that day. So pleased was the Admiral that his flagship was ready in time that he expressed his appreciation of the excellent way in which the officials (especially the engineering branch) worked with the officers and men of the ship in repairing and completing the defects. After lying in No. 3 Basin for over a year the battleship *Renown* has been placed in dry dock and overhauled. She has now been undocked, coaled and commissioned, her captain being the Marquis of Bristol (Captain Hervey, M.P., as he was recently). The vessel has also embarked a band. None of the fittings were disturbed on the vessel's return from India with the Prince and Princess of Wales, and they have remained in readiness in case the vessel was required for a similar duty. Rapid progress is being made with the repairs of the damaged destroyers. The *Quail*, which was in collision during the night of August 6, is having a new forepart built on to her. The *Teviot* and *Kestrel*, which were in collision the following night, have been taken out of dock. The latter has also had a forepart constructed, but the *Teviot's* damages were not so serious. The *Tiger* ran on to Portland Breakwater during night operations on September 25, and between thirty and forty feet of her keel under the fore part was torn away and there were two large holes further aft. She was on the breakwater all night, and how she managed to survive is a marvel. The *Bat* has been replaced in the Channel Fleet flotilla by the *Cygnet*, it having been found that several of her side plates were defective. Another vessel of that flotilla is here. The *Flirt* was completed on October 4, after being in dockyard hands for three months. She went out for her steam trials four days later and, on returning to harbour, ran into the North Wall, smashing her bows. The old "wooden walls" are gradually disappearing, the last to go being the line-of-battleship *Asia*, and there is now only the *Victory* left. Built in India, the *Asia* was the flagship at the battle of Navarino eighty years ago, but her subsequent career has been uneventful. She has of late years been used as a dormitory ship for boy artificers. The floating dock for submarines was towed across the stream on October 9 and placed in its permanent position in Haslar Creek. Its lifting power is 800 tons, and it will accommodate two boats of the "B" or "C" class at the same time side by side. Large storage tanks for oil are to built on the Gosport side of the harbour. They will be surrounded by earthworks and will be of a total capacity of 20,000 tons. The plans for the new lock are now in the yard, and we have had a visit from Mr. Marshall the director of dockyard and contract work, in connection with the matter. No. 3 basin, through which the new lock will pass, has been cleared and the water run off. The site of the present coaling wharf will also be required, but it is understood that the coaling arrangements will be supplemented by the addition of another floating depot similar to the existing C1 floating depot, but much larger.

Devonport Dockyard.

We now know something definite as to our new battleship, the drawings, with the orders for laying-off the ship in the mould loft, having been received from the Admiralty about the middle of the month. She will be considerably different from the original *Dreadnought*, and will form a unit in a new class—the *St. Vincent*—the name ship being built at Portsmouth. The new ship will be larger than the *Téméraire*, her length between perpendiculars being 500 feet, her beam 84 feet, and her displacement 19,250 tons. In the *Téméraire* the figures are 490 feet, 82 feet, and 18,600 tons. The new vessel will, therefore, be 10 feet longer, 2 feet wider, with 650 tons more displacement. Her length overall will be 536 feet, so she will be the longest ship ever built here. It is anticipated that a commencement in the actual construction will be made about the middle of November. Her name, by the way, is to be the *Collingwood*. Satisfactory progress continues to be made on board the *Téméraire* with the work of attaching the side and barbette armour. As regards the *Minotaur*, several of the steel castings were found to be defective, but it is expected that they will have been replaced by the beginning of November, and the 4th of that month has been provisionally fixed for her preliminary trial. The vessel will not be commissioned as early as had been expected, but if her steam trials pass off satisfactorily she will be ready for the penant within three years of being laid down (January 2). The damage to the hull of the battleship *Commonwealth*, caused by her recent grounding, having been made good, the vessel proceeded on October 7 to Portland to rejoin the Channel Fleet in readiness for the manœuvres. The cruiser *Andromeda*, of the Home Fleet, is to be reboilered. The boilers, which are of the Belleville type, have been working for about nine years, although the life of that kind of boiler is generally estimated to be about six years. New baffle plates will also be fitted. The battleship *Cæsar* was on October 16 moved under the sheer legs at No. 1 Jetty and had her four 12-inch guns hoisted out. They are of the Mark VIII. type, and have been in use for ten years. Three of the guns have been sent to Woolwich for overhaul, the other remaining here. The mountings are to be subjected to thorough examination. The repair ship *Cyclops* is due here at the end of October from the works of Sir James Laing & Sons, Sunderland. A captain has been appointed to her and she is, I believe, to be attached to the Home Fleet at this port. At a sale of old ships and stores the obsolete cruiser *Aurora*, which has been lying at Holy Loch, was sold for £12,700, the conditions of sale being that she is to be broken up within the United Kingdom, and the guns and engines mutilated to the satisfaction of the Admiralty in twelve months from the date of delivery. The old sailing brig *Pilot* was sold for £1225.

Chatham Dockyard.

The rumour has been in circulation that the Admiralty intend to lay down another cruiser here, but even should it prove true, which I doubt, there is no slipway available at present. No. 7 slip, from which the *Shannon* was launched, is occupied with the two submarines, while the new slip is being utilized for the construction of two paddle tugs, the keels of which were laid down at the beginning of the month. So it may be taken for granted that no ship will be begun during the present financial year. Still it is quite possible that when the Admiralty place orders for cruisers next year one will fall to our share. The two tugs are of 610 tons and will be named the *Rover* and *Grappler*. Their engines are to indicate 1400 horse power and will be the most powerful machinery fitted in any Government tug. The vessels are

intended for service at Devonport and Portsmouth respectively. The greatest care is exercised to prevent unauthorised persons obtaining access to the slip on which the submarines are being built, even officers commanding His Majesty's ships having to obtain special permits. It is generally understood that satisfactory progress is being made with the boats. That several improvements will be incorporated in their design goes without saying. The officials and men are very keen on the vessels proving a success, as it is felt that it will be a good thing for us if other orders are placed here. The armoured cruiser *Shannon* was to have been ready to leave about October 27 for her steam and gun trials. This is a departure so far as this yard is concerned, the practice having been for the gun trials to take place some time after the machinery tests. At the time of writing, her machinery is practically completed, whilst but very little remains to be done in connection with the gun mountings. Like the battleship *Africa*, the last vessel turned out here, the *Shannon* is fitted for oil fuel, but it is not expected that she will undergo that test during the forthcoming trial. Her departure will set free a large number of workmen, but there should be no difficulty in finding them work. It is doubtful whether in any previous year so many large vessels have passed through this yard for overhauls and refit. The latest arrivals were the battleship *Venerable* and the cruiser *Dido*. The former was laid down here at the beginning of 1899 and launched eleven months later, which was considered at the time a good performance. Since she was first commissioned at the end of 1902 she has done all her service in the Mediterranean, but her next commission will be in the Channel Fleet, in which she will replace the *Jupiter*. During the two months that she is to remain here the *Venerable* is to have her machinery overhauled and other alterations carried out. The *Dido* is to be ready to leave at the end of November for Colombo with a new crew for the cruiser *Encounter*, which is to be recommissioned for a further term of service on the Australian station. The battleship *Swiftsure*, having been completed, left on October 7 to rejoin the Channel Fleet, making a stay at Sheerness to ship her war department stores. The *Roxburgh* has also rejoined the First Cruiser Squadron. The cruiser *Blenheim*, which has been converted into a depot ship for torpedo boat destroyers, has been passed out of dockyard hands, and went down the Medway to Sheerness on October 7 to adjust compasses and ship stores preparatory to leaving with the Home Fleet for the exercises in the North Sea. Not having been docked since her return from the Mediterranean the *Bulwark* came up from Sheerness for her hull to be cleaned below the water line, and to be coated with anti-fouling composition in readiness to take part in the manœuvres. She is, I understand, to be refitted before she joins the Channel Fleet, in which she is to replace the *Ocean* in January. The *Warrior*, of the Fifth Cruiser Squadron, arrived on the 17th for some defects to be made good in her starboard engine. The destroyer *Mermaid*, of the Channel Fleet flotilla, came in about the same time, having damaged her bow during the exercises in the North Sea.

Sheerness Dockyard.

During the first half of the month we were very busy indeed. The harbour was full of vessels making preparations to take part in the combined manœuvres of the Channel, Atlantic and Home Fleets in the North Sea. The battleship *Dreadnought* not being available, the *Mars* was sent round from Devonport to take her place, the *Victorious* flying the flag of Vice-Admiral Sir Francis Bridgeman, the Commander-in-Chief. The *Essex* arrived from Portsmouth to join the flag of Rear-Admiral Callaghan, commanding the Fifth Cruiser Squadron, in place of the *Warrior*. The starboard high pressure slide valve of the latter vessel gave out when she went to Bantry Bay to calibrate her gun sights, and she returned here on October 2 with only her port engine working. She has since gone on to Chatham. When the *Venerable* arrived on October 8 on her return from the Mediterranean almost every buoy was occupied. There were the battleships *Venerable*, *Trafalgar*, *Swiftsure*, *Majestic*, *Victorious*, *London* and *Magnificent*, the armoured cruisers *Leviathan*, *Natal*, *Cochrane*, *Warrior* and *Black Prince*, and the protected cruisers *Blenheim*, *Endymion*, *Dido* and *Achilles*, besides scouts, torpedo gunboats and a flotilla of twenty destroyers. The port equipment has hardly kept pace with the number of large ships now using it. We have only one powerful tug—the *Diligent*—and she was in dockyard hands refitting. So if tugs had been needed to go to the assistance of a heavy ship we should have had to send at Chatham. The Home Fleet left for the exercises on October 14 and will return at the end of the month. The Fifth Cruiser Squadron left next day. The arrangements for coaling the ships worked very smoothly and everything was carried through without a hitch, while the supply of water to the ships was also most satisfactory. We continue to have plenty of work. The docks are all occupied and there are several destroyers and other vessels refitting in the steam basin. The *Welland* and *Ettrick* have rejoined the Home Fleet Destroyer Flotilla, and the *Seal* will soon be ready to join. The *Myrmidon*, of the Channel Fleet flotilla, and the *Violet* and *Success*, of the Devonport flotilla, are also in hand and will not be completed for a couple of months. The sloops *Vestal* and *Rinaldo* are making progress towards completion. Submarine "C 3," which has been in No. 4 Dock, is nearly out of hand. As each submarine of the Nore flotilla is to be docked in turn, the dock is likely to be used exclusively for that class of vessel for the next few months. The *Thames*, the parent ship, is at Chatham undergoing her annual refit. Captain Casement, the superintendent of the yard, is now second on the list for promotion to rear-admiral. He only entered on his duties in May, but promotion to admiral has been unusually rapid since then, and probably by the end of the year he will be promoted and leave us. A serious accident happened to the captain superintendent on October 18, when a test launch of the boom defence was taking place. Captain Casement was standing on one of the rafts directing the preparations for launching when the raft moved and he fell between the baulks of timber forming the rafts, a portion of which passed over him. He received a blow on the head, and was removed to his official residence in a semi-conscious state. Commander Lacy, the deputy superintendent, took charge of the operations, which were carried out in a very successful manner. Admiral Sir Gerard Noel, the Commander-in-Chief at the Nore, and Rear-Admiral Sir Henry Jackson, the Controller of the Navy, were present.

Pembroke Dockyard.

It is quite likely that the steam trials of the *Defence* will be postponed from March to July next. The engineer contractors will probably be ready by March, but the electrical work, which I mentioned last month, is so extensive that it is said to be quite impossible to complete it before July. The vessel is being fitted as a flagship and the bridge has a raised platform on the after side for the use of the admiral. The fore barbette has just been lifted into the ship intact. It weighed about seventy tons, and the shipment was effected by means of the sheer legs. The mainmast and topmasts will be put on board shortly. The latter will be 75 feet long, and the height of the truck above the load line will be 160 feet. This is in order to increase their utility for wireless telegraphy, the long gaffs hitherto fitted for that purpose having been dispensed with. The recently adopted method of cooling magazines by means of refrigerators is to be installed in the *Defence*, and the work is to be carried out before she leaves for her steam trials. Two boats for the *Defence* have recently been delivered from an Eastern Counties port, two from Southampton and two from Glasgow. Probably the Admiralty are sub-dividing small contracts with advantage, as the contractors are doubtless specialists in the building of the respective types of boats. It raises the question, however, whether it would not be better to revive the practice of building boats locally, as was done here for the last time in the case of the cruiser *Cornwall* five or six years ago. The *Boadicea* is making steady progress and the plating of the outer and inner bottoms and that of the decks is being proceeded with. In view of the postponement of the steam trials of the *Defence*, it has been proposed to berth the *Boadicea*, after her launch in the early part of next year, between the *Defence* and Carr Jetty while she is receiving her machinery. From an economical point of view, perhaps the proposal is advantageous, but it is questionable whether it would be wise to risk the vessel between the *Defence* and the jetty at a time of year when there is every reason to anticipate high winds and gales. A meeting of representatives of the public bodies and Chambers of Commerce at

Pembroke Dock, Neyland, Milford, Haverfordwest and Tenby was held at Pembroke at the beginning of the month, to consider the best steps to be taken with a view of inducing the Admiralty to establish a naval base here. Sir Charles Phillipps, Bart., presided. It was decided to form a deputation to wait upon the Admiralty later on, and in the meantime to issue a full statement of the case to all corporate bodies and commercial associations at the ports between Bristol and Barrow-in-Furness, and to invite their co-operation. It is not often that one hears of father and son receiving a pension at the same time. A shipwright here, fifty-eight years of age, has just been placed on pension whose father, also a shipwright, has been in receipt of a pension from the yard for twenty-four years. The father retired at sixty, having served thirty-eight years, during which period he rowed four miles morning and evening to and from Milford, where he lived. Along with others he made the passage with almost uninterrupted regularity in all weathers, on one occasion, in particular, during a storm which caused several vessels to break from their moorings in the Haven and go ashore. The old man must have rowed during his thirty-eight years a distance of more than three times the circumference of the globe.

INSTITUTE OF MARINE ENGINEERS.

At the Institute of Marine Engineers on Monday, October 7th, James Knott, Esq., J.P., Chairman of the Prince Line, Ltd., gave his inaugural address as President of the Institute for session 1907-1908. In the course of his address Mr. Knott gave a short sketch of the remarkable changes that have taken place in steamship owning in his experience, extending over thirty years. At the beginning of that period, when compound engines were the prevalent type, a steamer of 1500 tons burthen was looked upon as a vessel of large size, and the carrying capacity of the ordinary steam collier was about 600 to 700 tons. Then followed in quick succession triple engines and steamers of 3000 and 4000 tons, until we have now arrived at the period of the quadruple engine and vessels generally in the longer and regular carrying trades of 10,000 to 15,000 tons carrying capacity, while the popular collier of to-day is one of 3000 tons. These improvements have resulted in cheapening the cost of transportation to such an extent that it has given a mighty impetus to, and consequently produced a most profound change in practically the whole of the industries of the world especially those of North America, Northern Europe and the United Kingdom.

A change of even more marvellous importance has been going on in passenger vessels, which have just shortly ahead of the carrying steamers, entered upon the period of the turbine the latest and most up-to-date of which we have in the *Lusitania* and *Mauretania*, the most perfect and ideal specimens of marine engineering and naval architecture extant. While the cargo steamers have been entirely changing the features of the industrial world, the passenger steamers have been making as great a change in the social world, by providing means of travel so cheap, easy rapid and comfortable that wherever labour is not plentiful, or is inadequately paid, workers have facilities for moving from their own into new countries like North and South America where labour is more in demand and better paid. It was the genius of the British marine engineer which had devised and invented these improvements and no small credit was due to the Institute of Marine Engineers for assisting in this great work by the diffusion amongst its members of the latest and highest knowledge connected with the profession.

It was just nineteen years ago that month since Mr. Adamson the honorary secretary, had sent out circulars with the object of founding the Institute, and the position and work of the Institute to-day must be very gratifying to him. There was a total increase of all grades of membership of fifty four, the receipts in money amounted to £732 16s. 6d., and in volumes twelve. He regretted to say that several members eminent in the engineering world had been removed by death, including Mr. Walter Brock, Mr. Henry [illegible] and Mr. Ernest [illegible]ring. To-night there was to be a discussion on a paper by one of the members in New South Wales, and it was eminently satisfactory to know that there were good papers to follow throughout the session, in addition to lectures, fuel-testing experiments, Bohemian concerts and other social functions.

Mr. Knott then presented the Denny Gold Medal—founded by the late Peter Denny, LL.D., for the best paper read before the Institute during each session—to the honorary secretary, Mr. James Adamson, for his paper on "The Advantages of a Technical Society," read October 1st, 1906, and judged by the Committee to be the best for session 1906-1907. In making the presentation Mr. Knott remarked that, with so many calls upon his time in business and in the work of the Institute, it was highly creditable to Mr. Adamson that he should be able to write a paper of such excellence as to deserve the medal. In responding, Mr. Adamson expressed his appreciation of the honour conferred upon him, and after referring to the early struggles of the Institute said that now they had reached the 19th anniversary of the planting of the seed, they might reasonably congratulate themselves that the plant had vigorous life, and there was no reason why, on the attainment of its majority, the Institute should not enter as heir to another building worthy of its occupation and high ideals. Mr. W. Lawrie, Chairman of Council, in proposing a vote of thanks to Mr. Knott, said that in his address Mr. Knott had referred to the great changes in shipbuilding as being in the nature of romance. Mr. Knott's own career had been simultaneous with those changes and was a very romantic one also. Starting before fifteen years of age in an office on Tyneside, by his energy and ability he was now, at a still comparatively early age, at the head of a line of steamships, besides being connected with other business activities, and it was a great pleasure to have one of Mr. Knott's ability as President of the Institute.

A discussion ensued on a paper on "Salinometry," prepared by Mr. James Shirra, resident in Sydney and read on April 17th last, the honorary secretary reading Mr. Shirra's reply to the previous discussion and also correspondence which had been received on the subject. Mr. F. Cooper pointed out a statement which appeared to be contradictory to the general tenour of the paper, the author remarking that "engineers who work to limit gauges of ·0001 to an inch should remember that such accuracy is suspiciously unpractical." Mr. G. W. Newall suggested improvements upon the salinometer as used at the present time. Mr. W. McLaren remarked that it might interest the members to know that in the Bay of Biscay they once struck fresh water 18 ft. below the water line. Messrs. W. J. Gill, J. R Ruthven and A. H. Mather also spoke briefly on the subject. In closing the discussion the Chairman, Mr. W. Lawrie, remarked upon the thoroughness and detail with which Mr. Shirra had gone into the matter and the paper would be a valuable addition to the transactions. The meeting concluded with votes of thanks to Mr Shirra and to the Chairman.

The British Aluminium Co., of 109, Queen Victoria Street, sends us a few copies of price lists of sheets, ingots, bars, tubes and wire in this metal. The information is clear and will be of value to all those interested.

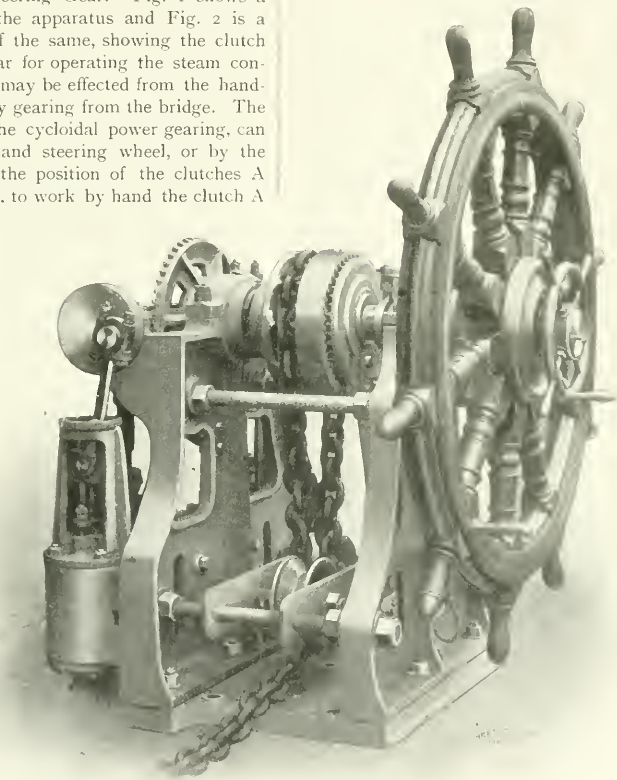
Messrs. Babcock & Wilcox, Ltd., of Farringdon Avenue, London, E.C. send us a copy of their marine catalogue, which shows the various activities of the firm here and abroad by means of photographs of works under their control in different countries, and vessels in the Navy fitted with their boilers. The particulars enumerated include the names of vessels fitted with this type of boiler. Particulars follow of each ship in the Navy so fitted and photos of vessels, which include the *Dreadnought*. The same thing is done for the U.S. Navy and many vessels of the U.S. Mercantile Marine, followed by others supplied to the Russian and the various Australian Governments. Besides the above, there are interesting facts found relating to the generation of steam, and particulars of apparatus fitted by the Company to their boilers. Illustrations are found of the methods of fitting these boilers in different classes of vessels, and a complete list of all vessels supplied with this type of boiler. It will be gathered, therefore, that this catalogue is replete with all particulars we should expect to find relating to the marine section of this firm's work.

ARCHER'S PATENT COMBINED STEAM AND HAND-STEERING GEAR.

WE illustrate, in the adjoining diagrams, a combined steam and hand-steering gear, which is a development of Archer's well-known Patent Self-holding Hand-Steering Gear. Fig. 1 shows a perspective view of the apparatus and Fig. 2 is a part sectional view of the same, showing the clutch arrangements and gear for operating the steam controlling valve, which may be effected from the hand-wheel, as shown, or by gearing from the bridge. The main shaft, carrying the cycloidal power gearing, can be operated by the hand steering wheel, or by the engine, according to the position of the clutches A and B. For example, to work by hand the clutch A is disengaged and clutch B engaged, and in this condition the gear is the patent self-holding gear, the chain wheel being actuated directly through the eccentric and pinion carried thereby, and the annular wheel with which the pinion engages.

To work by steam the clutch A is engaged and the clutch B disengaged; this couples the engine direct to the chain wheel through the power gearing. The loose bevel wheel, driven by the engine, has a screwed nut which engages a thread on the hand-wheel spindle, the end of which spindle is rotatably connected with a yoke, to which the bell-crank operating the control valve is connected. A slight turn either way of the hand-wheel will screw the spindle in an axial direction and open the control valve, and if the hand-wheel ceases turning further, the engine, in following the action of the control valve, will bring the spindle back to the normal or non-operation position, and so on the engine will continually meet the motion of the hand-wheel. It will be observed that all the working parts, apart from the engine, are carried on one shaft, and substantially within the same, and every part is very accessible and of simple construction. It is claimed that there is a mechanical efficiency of over 25% in comparison with the ordinary worm and worm wheel arrangement, and the gear does not continue to make a number of revolutions after the hand wheel stops.

These steering gears are made by the Dunston Engine Works Co., of Dunston-on-Tyne.



Archer's Patent Combined Steam and Hand Steering Gear Fig 1

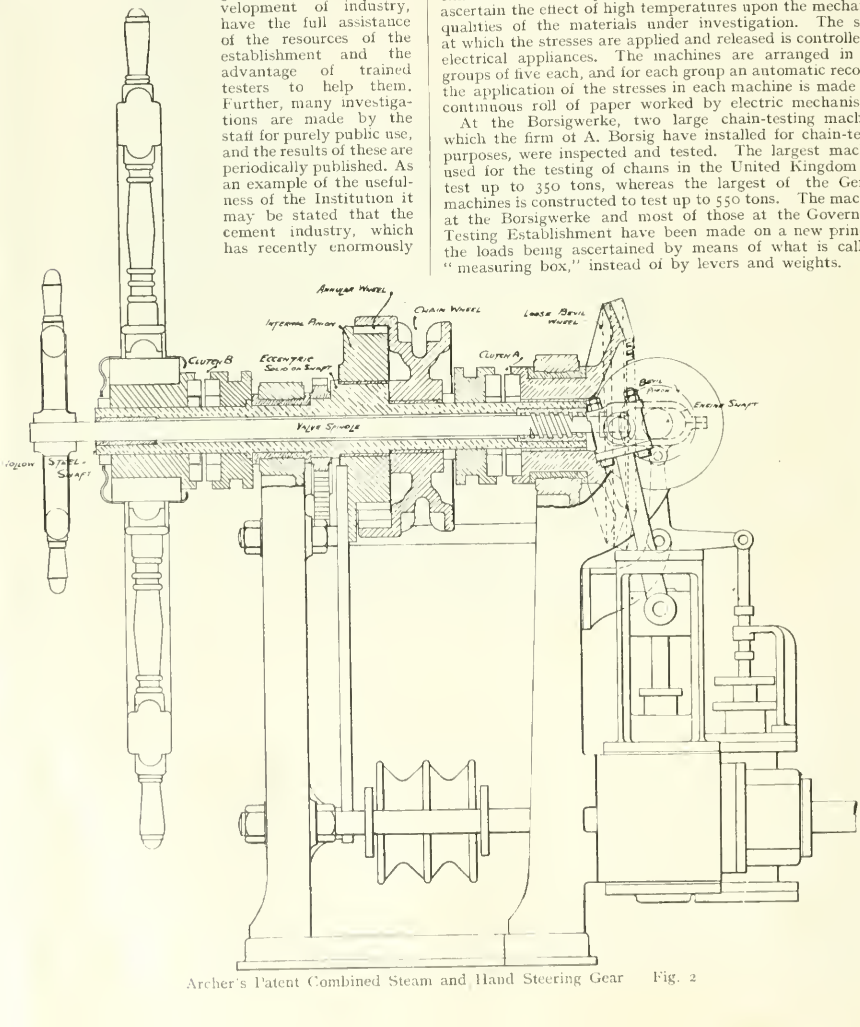
TESTING ESTABLISHMENTS IN GERMANY.

The Chief Engineer-Surveyor of Lloyd's Register of Shipping has reported to the Committee of that Institution the result of a visit he has recently paid to the Government Testing Establishment at Gross Lichterfelde, near Berlin, and to the Borsigwerke in Upper Silesia, and the observations contained in his report are of sufficient interest to call for public attention.

The Government Testing Establishment, it appears, is on a very extensive scale, and is partly self-supporting and partly maintained by the State. Any German manufacturer or user of material can have systematic testing carried out for commercial purposes in an impartial manner at reasonable charges; whilst inventors or manufacturers who desire complete and careful research into new ideas or processes can, if there is a reasonable prospect of the investigation leading to a development of industry, have the full assistance of the resources of the establishment and the advantage of trained testers to help them. Further, many investigations are made by the staff for purely public use, and the results of these are periodically published. As an example of the usefulness of the Institution it may be stated that the cement industry, which has recently enormously developed in Germany, owes much of its success to researches made in this establishment.

We have nothing like this establishment in this country. The National Physical Laboratory at Teddington, useful though it is, cannot approach the German establishment in results, owing to its small size and its limited resources. There is no doubt that much of the expansion of certain German industries is due to the assistance given by this national institution. This establishment is equipped with a very powerful testing machine for making tensile or compressive tests up to 500 tons, and there are in addition a very large number of testing machines in constant use, each designed for some special purpose. Amongst them is a set of twenty similar machines, each being used for testing the effect of "fatigue," or oft-repeated stresses on different materials; in some of these machines as many as three separate samples are being simultaneously tested. In most of them the tests are made at the normal temperature, but in others the test pieces are enclosed in asbestos-lined chambers electrically heated to definite temperatures to ascertain the effect of high temperatures upon the mechanical qualities of the materials under investigation. The speed at which the stresses are applied and released is controlled by electrical appliances. The machines are arranged in four groups of five each, and for each group an automatic record of the application of the stresses in each machine is made on a continuous roll of paper worked by electric mechanism.

At the Borsigwerke, two large chain-testing machines, which the firm of A. Borsig have installed for chain-testing purposes, were inspected and tested. The largest machines used for the testing of chains in the United Kingdom only test up to 350 tons, whereas the largest of the German machines is constructed to test up to 550 tons. The machines at the Borsigwerke and most of those at the Government Testing Establishment have been made on a new principle, the loads being ascertained by means of what is called a "measuring box," instead of by levers and weights.



Archer's Patent Combined Steam and Hand Steering Gear Fig. 2

PARAGRAPHS.

The Glacier Anti-Friction Metal Co., Ltd. have removed their offices to 112A Queen Victoria Street, London, E.C., directly opposite their old premises.

Heath & Co., Limited, of Crayford, London (agent P. Bauhain & Cie., Bordeaux), receive the Grand Prix at the International Maritime Exhibition at Bordeaux for marine instruments. Their sextants, sounding instruments and compasses especially have called forth the warmest praise for their perfection of workmanship and the ingenuity with which every need of the navigator seems to be foreseen and provided for.

Ventilation.—The well-known firm of R. Boyle & Son send us a neat little brochure got up in a very artistic manner and describing their system of ventilation. The descriptions are interspersed with quotations from outside authorities on the subject generally, and as these quotations and descriptions are short, one only on each page, the space left calls attention to the matter. The system of the little book is therefore distinctly novel with its white covers and artistic printing.

The Lunken Valve Co., of Gt. Dover Street, S.E., send us a neat catalogue of their external spring indicator, with full illustrations of its internal arrangement. The spring is on the outside above the pencil movement, and thus remains perfectly cool when in use. We have also a continuous drum movement shown and indicators for high pressures. Reduction gear and other accessories, such as indicator locks and planimeter are found, and these are all priced.

Central Marine Engine Works.—We have a catalogue by the Central Marine Forge of West Hartlepool, showing the class of forgings made by the firm up to 17 tons in weight. As these are mostly for marine work, such as stern and rudder frames, tiller heads, and crank and tail shafts, they will nave great interest for marine engineers. Smaller details, such as gear for winches and donkey pumps follow, and many others of a more general character, the prices of which are generally annexed. The details are all illustrated and therefore it is easy to follow them.

Mr. Chas. Taylor, of Bartholomew Street, Birmingham, sends us a catalogue of his patent spiral chucks for lathes, in which he shows the value of his system for holding power in the lathe necessitated by using the high-speed steels common now. Diagrams of this system in comparison with the ordinary one follow and the elaborate character of that by this maker is apparent. Nothing is wanting to make the matter complete in every detail and the value of the system is made clear. Prices are given, with dimensions and full illustrations.

We have before us a catalogue of the "Stellite" Motor Starters and Switchgear Panels, as made by the Electric and Ordnance Accessories Co., of Birmingham, in which the solid construction of this panel is clearly visible and the internal parts shown. Prices and code words are found of the gears in every make by this firm. Motor Starters by the firm are dealt with in the same way, and at the end we have diagrams and dimensions of the Starters, with wiring diagrams of the Starters and Panel in various cases for thrust and series wound motors. Prices are given in every case, with code word.

Tuck & Co., Ltd., inform us that in order to deal with an increasing volume of trade, they have found it necessary to open a ship and contract department at Sussex House, 52, Leadenhall Street (with an entrance from 107, Fenchurch Street), under the charge of Mr. A. Turner Richardson, and it will facilitate matters if all orders for ships are sent direct to this address. The new office will be in telephonic communication both with the head office and the works, thus enabling them to effect a considerable saving of time in the despatch of orders.

External Perception.—At the Institute of Marine Engineers on Monday, October 21st, a lecture on "External Perception" was given before the Junior Section, by Mr. James Adamson (honorary secretary). The chair was occupied by Mr. Alex. Boyle (vice-president). The lecturer opened by remarking upon the imperfect nature of the knowledge of the external world gained by sensation alone. Dividing the subject of perception by the senses into the two main heads of self-consciousness and perception of the external world, he followed the sensations produced and knowledge obtained from projecting a square upon paper. Passing on to the theories of the sensational school, he commented successively on the ultra-sensationalism of Hume, pantheism and materialism. The two main theories in reference to perception were idealism, which considered both the external world and the percipient as cousisting of mind, and considered further, that the essence of both self and the external world was mind, not matter, while realism, on the other hand, saw the world immediately, without the intervention of the images of idealism. Each of these two main divisions was sub-divided, the lecturer briefly criticising the theories held by the various schools of subjective, objeetive and absolute idealism, and inductive, inferential and representative realism.

W. H. Bailey & Co., Ltd., Salford, Manchester, exhibited at the late Engineering and Machinery Exhibition a large variety of their specialities, consisting of air compressors, steam pumping engines for boiler feeding and general purposes, and boiler mountings and engine fittings of almost every type. The "Köster" patent air compressor, of which two or three types were shown, is a machine which gives the highest volumetric and mechanical efficiencies. It has a mechanically operated piston valve for admitting air to the cylinders, and only one outlet valve, the action of which is controlled by the piston valve, so that it is allowed to open wide and to seat itself noiselessly. Opening wide, it can be made small in diameter, leaving the whole of the cover of the cylinder and a great part of the cylinder jacket available for cooling. The valves opening wide enable the compressor to be run at high speeds, making it particularly suitable for being driven by the most economical type of steam or gas engine or by electro motor. The compressors are made on the single and the mutliple-stage combined inter-cooling systems. All parts are well proportioned, and wear and tear and the costs of upkeep are reduced to a minimum. Another of the firm's exhibits was the "Davidson" direct-acting steam pump. The feature of this pump is the range of speeds at which it can be driven, *viz.*:—from 1 or 2 strokes to 200 or 300 strokes per minute. It is made with either pistons or rams for high-pressure boiler feeding, working hydraulic presses and for very high lifts in mines, and can be fitted with simple, compound or triple expansion steam cylinders. We must refer also to the "Key-ring" renewable valve seat, which is fitted in stop valves for high pressure superheated steam. It allows for differences of expansion between the seat and the body and can be easily removed and replaced. The principle of the "Key-ring" is the adoption of a flexible metallic connection between the seat and the body, similar in construction to the well-known Ramsbottom piston ring. The seat of the ordinary type is screwed into a spring ring, which is sprung into a groove in the valve body. The seat can be removed and replaced with ease, will expand freely in all directions and remain tight under all pressures and temperatures. As showing the enormous variety of goods made by this firm we call attention to the Thurston's patent recording oil tester, and the Bailey's patent hydraulic installation recorder. The former machine is designed for users of large quantities of oil to enable tests to be made to demonstrate the most suitable oil for certain work. Many conditions have to be carefully taken into consideration in selecting oil for different kinds of work, and by the aid of this machine the necessary good or bad qualities can be found. It also records on a diagram the behaviour of the oil during the test. The other exhibit referred to—the hydraulic installation recorder—is an instrument specially designed for use in connection with hydraulic Power stations. It can be connected to any number of pumping engines and records on a diagram the duties of these engines by giving a puncture for every 100 revs. and from this diagram the quantity of water delivered can be calculated. The recorder shown was specially made for the new hydraulic power station at Falcon's Wharf, London. Of valves for controlling steam, air or water, many interesting types were exhibited. The "Foster" reducing valve is a spring controlled valve which will open from any degree to full bore, according to the demand made on it. This is accomplished by means of its differential spring arrangement, which maintains a constant pressure on the governing diaphragm, irrespective of the degree of compression of the spring. A passing reference might be made to the innumerable patterns of lubricators, steam gauges, water gauges, for boilers and other fittings shown by this well-known firm.

CAST-IRON BRAZING.

SUCH a material is before us, as the heading indicates, and named by the makers "Castolin."

A few years ago a discovery such as this would probably have been considered impossible of attainment, yet, as in many other cases of this kind, we have, in these days, ceased to wonder. To be able to braze cast-iron and repair a flaw, is obviously of the greatest importance in engineering. These fractures do occur and cannot be prevented, and such an application as this we have before us is in the nature of a landmark on the road of progress, in a scientific sense.

Particulars of Tests carried out by D. Kirkaldy & Son, London, E.C.

"Castolin Process."

Results of Experiments to ascertain the resistance of Pulling and Bending Stresses of six Cast-Iron Bars, three of which had been jointed, received per Mr T. W. Sheffield

PULLING STRESS.

Test No.	Description.	Dimensions Dia.	Dimensions Area	Ultimate Stress. Total.	Ultimate Stress. Per sq. inch.		Ratio of Joint to Solid.	Appearance of Fracture.
pp.	Cast off pattern supplied.	inch.	sq. in.	lbs.	lbs.	tons	per cent.	
4057	Solid.	·949	·707	17,560	24,837 =	11·1	—	Slightly Unsound.
4059		·949	·707	22,980	32,505 =	14·5	—	Sound.
4061		·949	·707	17,380	24,583 =	11·0		Unsound.
				Mean	27,308	12·2		
4063	Broken about mid-length and jointed by "Castolin process."	·949	·707	13,630	19,279 =	8·6	70·6	Broke at joint.
4065		·949	·707	16,180	22,885 =	10·2	83·8	
4067		·949	·707	14,800	20,933 =	9·3	76·7	Broke at unsound spot, clear of joint
				Mean	21,032 =	9·4	77·0	

BENDING STRESS. Load applied at centre. Distance between supports, 12 ins.

Test No.	Description.	Dimensions.	BD²	Ultimate Stress	Ratio of Joint to Solid.	Ultimate Deflection.	Appearance of Fracture
pp.		inches. B D machined.		lbs.	per cent.	inch	
4058	Solid	1·00 × 1·00	1·00	3041	—	·153	Sound.
4060		1·00 × 1·00	1·00	3015	—	·148	
4062		1·00 × 1·00	1·00	2929	—	·145	
			Mean	2995		·149	
4064	Broken about mid-length and jointed by "Castolin process."	1·00 × 1·00	1·00	1939	64·7	·062	Broke at joint partly through solid.
4066		1·00 × 1·00	1·00	1564	52·2	·057	
4068		1·00 × 1·00	1·00	1862	62·2	·058	
			Mean	1788	59·7	·059	

The Bars for the above Tests were brazed by a Journeyman.

PULLING STRESS.

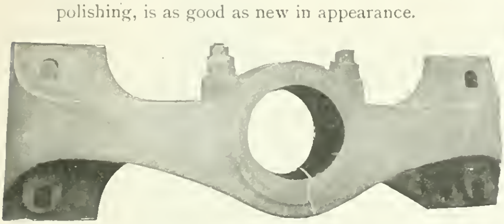
Test No.	Description.	Dimensions. Dia.	Dimensions. Area.	Ultimate Stress. Total.	Ultimate Stress. Per sq. inch.		Ratio of Joint to Solid	Appearance of Fracture.
pp.	Cast off pattern supplied.	inch. turn'd	sq. in.	lbs.	lbs.	tons	per cent.	
3955	Solid.	·835	·548	11,860	21,642	9·7	—	Sound.
3957		·832	·544	11,080	20,368	9·1	—	
3959		·838	·551	10,980	19,927	8·9		
				Mean	20,646	9·2		
[illegible]	Broken mid-length and jointed by "Castolin process."	·826	·536	9340	17,425	7·8	84·4	Broke at joint
[illegible]		[illegible]	·548	6390	11,661	5·2	56·5	
[illegible]		[illegible]	·538	9160	17,026	7·6	82·5	
				Mean	15,371	6·9	74·5	

BENDING STRESS. Load applied at centre. Distance between supports, 12 ins.

Test No.	Description.	Dimensions.	BD²	Ultimate Stress	Ratio of Joint to Solid.	Ultimate Deflection.	Appearance of Fracture.
pp.		inches. B D machined.		lbs.	per cent.	inch.	
3956	Solid	1·00 × 1·00	1·00	2297	—	·123	Sound.
3958		1·00 × 1·00	1·00	2310	—	·115	
3960		1·00 × 1·00	1·00	2210		·130	
			Mean	2272		·123	
3962	Broken mid-length and jointed by "Castolin process."	1·00 × 1·00	1·00	1515	66·7	·064	Broke at joint partly through solid.
3964		1·00 × 1·00	1·00	1403	65·7	·068	
3966		1·00 × 1·00	1·00	1562	68·7	·059	Broke at joint.
			Mean	1523	67·0	·064	

The Bars for the above Tests were brazed by an Improver.

This under notice was shown at the recent Olympia Exhibition. It makes so good a joint that a casting will not break in the same place again. This claim has been proved by tests by well-known engineers in England, such as Messrs. Jas. Archdale and Co. The product is the result of years of application, and no difficulty is experienced in using it. The method is to rub the material into the pores of the broken parts of the metal. The pieces are then joined together accurately with clamps, placed in a cleaa charcoal fire, and when hand-warm more of the "Castolin" is rubbed into the fracture. The line of separation is covered with plenty of borax and "Castolot" spelter, and the casting replaced in the fire and brought up to a red heat, until the "Castolot" spelter runs with a bluish flame. The brazed casting, after polishing, is as good as new in appearance.



This description serves to make clear the value of the invention, and it is apparent to users what a saving in time and money follows from its adoption, because there is thereby no need to resort to the foundry for another casting. The claim the makers put forward is that a pot of "Castolin" will obviate the necessity of keeping spare parts of machinery in stock, and the consequent lock up of money. A few hours only are sufficient to complete the operation we have described.

Turning to our illustration, we have an engine-bearing shown repaired after this manner, and the tensile strain is given at $9\frac{1}{2}$ tons on the square inch after brazing has been effected. The cost, too, is not excessive, and said to be much cheaper than any other process of a similar character.

We append results of tests made by the well-known firm of Messrs. D. Kirkaldy & Son.

It is unnecessary for us to make any comment on these figures. They seem favourable generally to the system, and that practical firms have made their own tests points to the value of the method.

The makers are Messrs. Wassermann & Co., 11, Queen Victoria Street, to whom further application should be made.

The Electric and Ordnance Accessories Co., Ltd., have been awarded a gold medal by the New Zealand International Exhibition. In this exhibit, a special feature was made of the Stellite telephones and telephone accessories, in addition to their general electrical manufactures. The exhibit was in the hands of their sole agents for New Zealand, Messrs. C. A. Hamlin & Co., Auckland.

ELECTRICITY ON BOARD SHIP.

XIV.*

By Sydney F. Walker R.N., M.I.E.E., Assoc. M.I.C.E., etc.

Sizes of Cables for Distributing the Current.

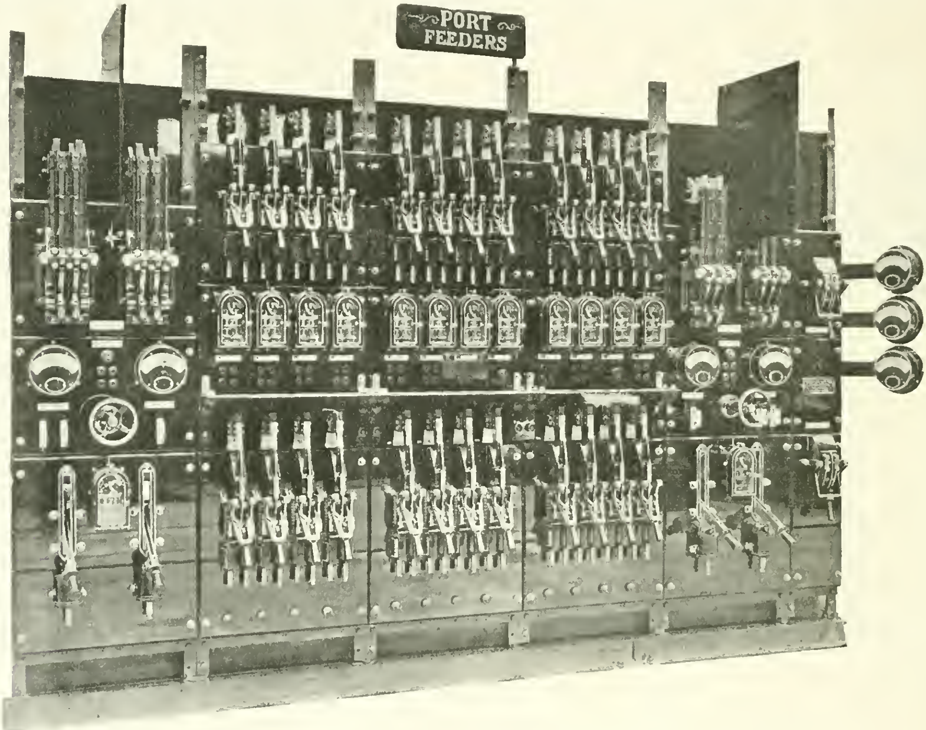
THE case mentioned at the end of the last article, in which a large portion of the lights, or the motors are switched off during a certain part of the twenty-four hours, may be met in two or three ways. The simplest arrangement is that suggested by an examination of the formula given in the last article, $E = C R$. If R is made very small, so that the variation in C at different parts of the day makes no appreciable difference in E, the problem is solved, and in the most effective and simple way possible. Thus, taking the example given. If there are 800 lamps to be supplied by a particular pair of main cables and its branches, and if the total fall of pressure between the main switch-board and the terminals of the farthest lamp is only two volts or thereabouts, the difference in the pressure delivered to any lamp, when half of them are turned out, will be only one volt, which, as explained, is not visible in the light, except at the moment of change, and then only if the whole of the lamps are switched out together, and again only for an instant. Unfortunately this leads to the requirement of cables of very large size, as instanced in the cables of the *Lusitania*; and though it is money well laid out, in the writer's opinion, to provide large cables, and so to do away with all necessity for the regulating apparatus to be described, in very many cases the owners of ships will not meet the expense, and other means have to be devised. It should be mentioned incidentally that in addition to solving the problem of the regulation of light, large cables also stand better, there is a much larger mass to be eaten away, in case of salt water getting to them, and they are, therefore, less likely to be parted quickly by electrolytic action, but on the other hand large cables are difficult to make sufficiently flexible to handle conveniently on board ship, particularly with the modern practice of water-tight compartments.

One method of avoiding the necessity of large cables was alluded to in the last article, *viz.*, arranging the lights that are to remain burning on one set of cables, while those that are switched out are on another set. In modern steamships lighted by electricity, the plan has been wisely adopted of wiring saloons, smoke rooms and principal passenger quarters with at least two sets of supply wires and cables, so that in case of anything happening to one set, the lamps supplied by the others are still burning. This arrangement can be carried farther, and, since it is usual, in the great liners at any rate, to have two or more generators running together, during the period of heavy load, those that are running during the period of light load, whether one or two, can be worked at a lower pressure, providing that the lights in the other parts of the ship, and any other service heating or motor service, will allow of this. This is one of the cases where the "independent" system of running dynamos has certain advantages. During periods of light load, if there are certain apparatus requiring higher pressures than the bulk of the lamps, etc., necessitate, according to the size of the cables, the apparatus that is requiring the higher pressure can be supplied from one dynamo, and the remainder from another, or two. With the "parallel" or "bus bar" system, as everything has to be regulated from the main switch-board, any difference in the pressure between the different supply cables has to be made there. Differences of pressure in the different machines cannot be introduced, except for the purpose of making them take more or less of the load, as explained in the previous article.

The next method is the one that was mentioned in the article describing the different forms of dynamos, and is known as "compounding up." It was explained that in the compound machine the series coils provided the additional magnetism in the cores of the field magnets, required to make up for the loss of pressure due to the passage of the main current through the armature coils, and that it was possible to carry this beyond the point at which the pressure at the dynamo terminals was maintained constant, and to give an increasing pressure at the terminals, with increasing current so that the pressure at the distributing

* For Articles I. to XIII., see last thirteen issues.

points, say at the end of the main supply cables, would be maintained constant. Thus, taking the case given in the last article, of a pair of 193 No. 13 wires, each 100 yards long, and having a combined resistance of 0·004 ohm, and making a charge for the passage of a current of 500 ampères of two volts. Instead of the pressure at the bus bars being maintained constant at 100 or 102, or whatever may be the figure arranged, the pressure at the end of this pair of cables could be maintained at 100 or 102, the pressure at the bus bars and at the terminals of the dynamos increasing proportionately. Thus, if the pressure at the distributing point was arranged to be 102 volts, with the full 500 ampères going through, the pressure at the bus bars would be 104, and presumably the pressure at the terminals of the lamps would be from 100 down to 98. When, say, half of the lamps were turned out, the pressure at the distributing point at the end of the pair of cables would still be 102, but the pressure at the bus bars would be only 103, the pressure at the terminals of the lamps being still from 100 down to 98 volts. Providing that the amount of increased pressure at the bus bars given by this method is not serious, it makes a very useful and simple method of solving the problem; but if the difference of pressure at the bus bars is considerable, it will mean that any lamps or apparatus that are supplied directly from the bus bars, or by means of short cables from them, will be subject to too large variations. The lamps in the electrical engine-room itself, which will be supplied from the bus bars, will be subject to the difference in pressure necessitated by this method. Thus, in the instance given, the difference in pressure at the bus bars would be only one volt, and would not affect the lamps or other apparatus supplied directly from them; but if the cables had been cut down so that there was a difference of pressure of six volts at the bus bars, between times of full load and times of light load, the lamps and apparatus directly supplied from the bus bars would either be strained during the times of light load, or would be giving a poor light during the times of heavy load. It is possible to get over this difficulty even with comparatively large differences of pressure, by inserting resistances in the wires or cables supplying apparatus directly from the bus bars, the resistance being inserted gradually, as the pressure goes up; but there is the great objection to this that it makes additional complication in the electrical engine-room. Those who have had the laying out of electric lighting and power plant on board ship have very wisely kept the apparatus as simple as possible; and though with the increased experience, and with increased general knowledge of electricity now ruling, more and more complications may safely be indulged in, it is still wise to keep the apparatus as simple as possible in matters of this kind. Space is always limited, and apparatus of the kind demand space. Further, in a heavy seaway, apparatus of the kind are apt to be a nuisance, especially if, as is usually arranged, they are automatic. One arrangement that was employed on shore, in a case of the kind, consisted of a resistance formed of coils of wire, divided into sections, the junctions of the sections being brought up to plates on a contact board, similar to those employed for starting electric motors, and a contact arm swept over the switch contacts, the arm being actuated by the core of a solenoid electro magnet, whose coils were included in the circuit of the lamps whose pressure was controlled. It worked very well.



One of the Switch-boards fixed on board the new Cunarder, "Mauretania," by Messrs Ferranti, Ltd
This board is principally devoted to one half of the distributing cables, or feeders

Another method that is sometimes employed on shore is to insert resistances in each of the supply or feeder cables, the resistances being carried at the back of the switch-board and controlled by the usual contact bar, moving over a

number of contact stops, connected to different portions of the resistance, the resistance being added or subtracted by hand by the attendant. This again takes up space, and is an additional apparatus to look after and to get out of order.

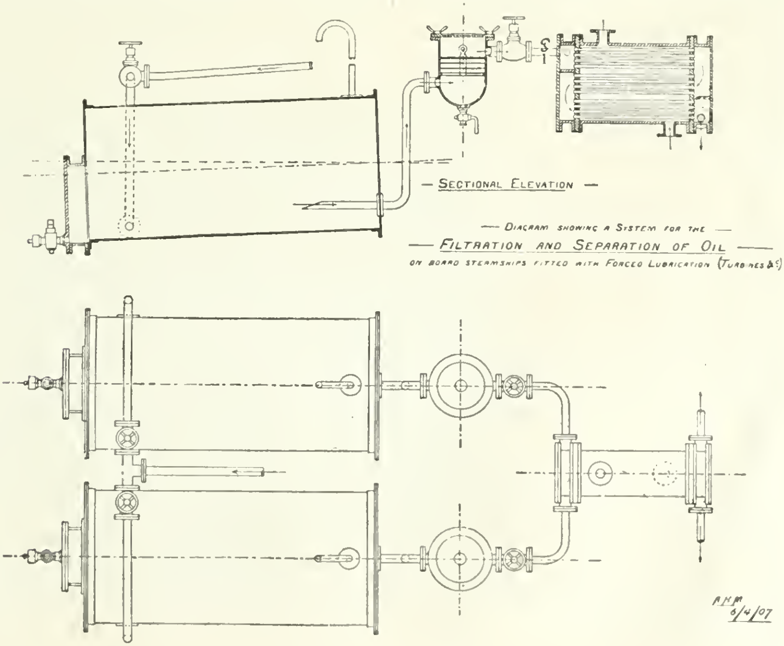
There is another method, also employed on shore, to meet the difficulty. It is applicable, in the writer's view, to board ship work, with the increasing knowledge and experience of electrical apparatus referred to. It is known as the "booster" system. The booster is an apparatus similar to the balancer that has been described. It consists usually of two machines, one of which acts as a motor, its coils in this case being connected as part of the circuit to be "boosted;" and a generator whose armature is driven by the armature of the motor. The generator provides an additional pressure for the service that is to be "boosted," the additional pressure being in proportion to the additional current that is going out, when the load is up. The additional pressure is added to the normal pressure of the service, and the action is practically the same as that of "compounding up," except that the booster may be thrown out of gear entirely if desired, and that it is also under control to a certain extent by means of the excitation current of the generator half of the machine. There is the same objection to the use of the booster as to the other apparatus that have been described. It is an additional machine to look after, and it brings additional complication to the switch-board. But, on the other hand, it enables the cables to be considerably reduced in size. It involves the usual reference to the balance sheet to show whether it is more economical to provide larger cables or one of the apparatus that have been described.

The difficulty that has been mentioned in connection with the variation of pressure at the lamps occurs in many instances on shore, in town electricity supply. In many cases the feeder cables have been laid down with a view to the supply of a certain number of lights, and, as time has gone on, these have been largely exceeded, particularly on such occasions as Saturday night, and the result has been that on these occasions the pressure at the bus bars has been increased considerably, in order to provide for the larger load. The pressure at the lamps near the station has increased in the same proportion, the light given for the time being very good, but the life of the lamps being very much reduced.

The illustration shows one of the main switch-boards supplied to the new Cunarder *Mauretania*, by Messrs. Ferranti Ltd. The board is principally devoted to one half of the distributing cables, or "feeders." Each pair of feeders has its own positive switch below and negative above, the positive and negative "cut-bars" being behind the board on a level with the contacts of the switches. Between the two sets of switches are the time limit cut-outs referred to in the last article, one for each pair of feeders.

MARINE TURBINE LUBRICATION.

AT the Institute of Marine Engineers on Monday, October 14th, a paper was read by Mr. A. H. Mather (honorary treasurer), on Marine Steam Turbine Lubrication. Mr. W. Lawrie (chairman of Council) presided. Mr. Mather, in enumerating the qualities required for an oil for this class of work, stated that it must be entirely free from saponifiable matter, it must separate rapidly from any water picked up in its passage through the system, it must retain its lubricating value when heated to a fairly high temperature, and it must retain its nature in continuous use for long periods. In forced lubrication, to ensure the oil being kept up to its standard, the two most important points to be considered were its complete separation from water and its thorough filtration from grit or other material substances. The installation that he suggested for a turbine ship, as shown in diagram, would consist of two storage or settling tanks, two filters, an oil cooler and a force pump. The two tanks are placed low down in the engine-room to allow the oil in the bearings to drain freely back by gravity. The tanks are tilted and the drain-cock placed so that it is two inches lower than any other part of the tank. An air-pipe is fitted at the highest point. The oil return pipe from the bearings should enter the tank as near to the bottom as possible, and he recommended that the oil be allowed to return in its heated condition in order to facilitate its separation from the water



Marine Turbine Lubrictiaon.

on entering the tank, a small heater being provided in cases where a large proportion of water found its way into the oil. The pump suction pipe should be placed as high as possible, so as to allow ample space for the accumulation of water and extraneous matter to remain at the bottom without being drawn through. The tanks should be used alternately every two or three days, and two filters also should be supplied to allow of one being used while the other is being cleaned. After being filtered the oil should pass through a cooler having sufficient surface and water circulation to reduce the temperature to normal. The most efficient form of cooler, he considered, was one with a series of tubes with expanded ends in a casing through which sea-water could be pumped. The oil pump was placed between the filter and the cooler, so that any leak occurring would allow a leakage of oil outwards instead of water inwards.

In the discussion which followed, Mr. John McLaren considered that if the inlet pipe were at the top of the tank it would facilitate separation of the water and dirt. Mr. J. G. Robertson questioned the necessity of a filter, in view of the absence of grit or dirt in the oil in turbines. On a sample of oil being taken from the *Kingfisher* after running the whole season last year, it was equally as good as at the beginning. Mr. F. M. Timpson stated that he understood the Parsons Company recommended filters. From his own experience he found that dirt did get into the oil. Mr. J. Clark said that he understood in turbines forced lubrication was the only kind used, other methods being of no use on account of the centrifugal action. He was under the impression that there were some kinds of oil that might get into the boilers without doing any harm. He was not sure whether the pipe system of cooling was a good one; where there was only one inlet and one outlet the cooling water did not diffuse. Mr. G. W. Newall asked whether the weight on the bearings of the turbine was not decreased when running at a high speed. He also asked what was the comparative oil consumption of turbines and reciprocating engines, and whether grease could not be used as a lubricant. Mr. W. R. Watson suggested a separate gravity filter, which would throw less work on the oil pump. Mr. Mather, in replying, pointed out that the dirt was drained from the tank by means of the drain-cock, which was placed at the lowest point. Dirt did gather in the oil, and the fact that filters were used in almost every instance went far towards proving their necessity. He thought that it was always best to keep oil out of the boilers. The cooling water should be split up and baffled, in which case it would be diffused throughout. The consumption of oil in turbines was extremely small compared with that of reciprocating engines. He did not consider that grease would be suitable for forced lubrication.

Mr. W. Howell was of opinion that the number of tubes in the cooler increased the risk of leakages. Mr. Newall questioned whether the oil could be used over and over again without losing in quality. Mr. Howie commented on the difficulty of forcing the oil through small pipes. He described a method of testing the quality of the oil. He did not agree that any allowance should be made for decrease in pressure on the bearings after the turbine was started. Messrs. Newall, Howell and Timpson gave instances to support the contention that there was practically no wear on the bearings. Mr. A. G. Rainey mentioned that cooling was sometimes effected by mixing the oil with clean fresh water, but the chairman stated that in his experience this method had not proved economical. Mr. Mather afterwards replied to the further questions that had arisen, and the meeting concluded with votes of thanks to the author of the paper and to the chairman.

Gauges.—In these days of accurate measurement, a firm making gauges assumes a prominent position, and among these is the Newall Engineering Co., Ltd. of Warrington, who send in their list a handsomely got-up production. The reading matter is small type-written and therefore easy to decipher. The illustrations are particularly clear. The type [illegible] of a fawn colour, the blackness of the illustrations is more prominent. The gauges shown include screw and taper. There are face plates and measuring machines, with lists of each and prices at the end. The system adopted here is worthy of attention and those interested in this class of goods should not miss this opportunity.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

Ships' Magnetism.

A PAPER has recently been read before the North-East Coast Engineers, which shows the desirability of constructing the hull of a vessel of non-magnetic material and it is recommended from actual practical tests on the s.s. *Thueringen* that in the neighbourhood of the compass, unmagnetic material had been used with effective results, the steel alloy containing 23 per cent. of nickel.

Wireless Telegraphy.

In view of its extreme importance and connection with the subject as applied to ships, the announcement that the Marconi Company has commenced a service across the Atlantic merits attention. A message of forty words took only ten minutes to bridge the ocean. The perfection of the sending and receiving stations has been in progress for some time and therefore we have been in a measure prepared for the result, but by the success obtained the statement that messages would be despatched at the rate of 5d. a word becomes nearer realization.

New Filament for Incandescent Lamps.

The experimenters in this field are numerous and from a paper recently prepared, we gather that a new material is that known as Helion, which is a form of silicon deposited on a base of carbon very similar to the ordinary filament, giving, it is said, a great increase in brilliancy. If sufficient deposit is made, 110 volts may be absorbed with one loop only. Lamps have thus been produced consuming 30 watts and giving 30 c.p., withstanding a temperature of 1750° without apparent disintegration or blackening of the globe. From a table given, the carbon filament lamp required 9 watts per candle, while the Helion filament at the same temperature 1380° required only $3\frac{1}{2}$ watts. The disintegration of the carbon filament was so rapid under these conditions that the efficiency fell off quickly, but the Helion filament was carried up to 1700° at which temperature it consumed 1·07 watts per candle power. In thus varying temperature the resistance of the carbon filament decreased 4 ohms, while that of the Helion increased $5\frac{1}{2}$ ohms. Life tests show that at 1 watt per candle-power the life was as long as 1200 hours and in a number of cases 700 hours, the drop in candle-power being very small, about 3 per cent. The lamp failed at the joint of the filament to the leading-in wires. The experimenters consider the lamp will be brought to practical commercial utility as a result of their work in the laboratory.

Olympia Exhibition.

A prominent exhibit was that of Messrs. S. Wolf & Co., with their electrical drills. The very light drills up to $\frac{1}{4}$ in. are well designed and constructed, though they weigh only 6 lbs. A feature of these machines is the way in which the switch for starting and reversing is housed within the motor casing. The switch is also within reach of the operator's fingers. Among the exhibits on this stand are a number of small motors on trolleys or in slings, fitted with flexible shafts for drilling at a distance. Messrs. Bergtheil and Young showed a novel form of electric punkah, which is stated to produce exactly the action of the hand punkah common in India. The arrangement consists of a rigidly suspended motor and a swinging frame to which a fabric is loosely hung. A quadrant and pulley, the former controlled by a spring, are so arranged that after the motor is started, the pulley rolls against the quadrant and carries it away from the vertical position and this is so far that gravity tends to make it swing back again. On the return stroke, the motor being still running, the quadrant strikes the opposite side of the pulley, and the punkah is swung in the opposition direction, the cycle of operations being repeated continually while the motor runs.

Gas Engines and Producers.—We have before us a small catalogue of gas engines and gas producers made by D. Gorrie and Son, of Perth. The gas plant apparatus is shown in section and prices of the various sizes given. The gas engines this firm make are also shown and priced in list. To those interested in this class of apparatus, this catalogue is likely to appeal.

REFRIGERATING INSTALLATIONS ON R.M.S.P. CO'S. STEAMERS

MESSRS. J. & E. Hall, of Dartford Ironworks, Kent, have supplied several large Refrigerating Plants, on the CO_2 (Carbonic anhydride) system for the Royal Mail Steam Packet Company, and the following will give a general idea of the plants as installed on the new vessels of the **A** class, which trade between Southampton and the River Plate.

These vessels have been fully described in our previous issues, and are among the most luxurious passenger vessels afloat.

Messrs. J. & E. Hall introduced the first CO_2 machinery into this country in the year 1889. The machine was made to the designs and under the patents of Mr. Franz Windhausen, of Berlin. Since then considerable improvements have been made, and the system is now firmly established, as is evidenced by the number of machines which this firm now turn out annually, also by the fact that several other firms have taken up the manufacture, and the system is now becoming quite common, especially aboardship, where its peculiar advantages render it eminently satisfactory.

The essential parts of the machine are :

1. An *Evaporator*, which contains lengths of pipe, inside which the CO_2 evaporates, absorbing heat from the material to be cooled, which surrounds the pipes, and which, in the present instance, is brine.

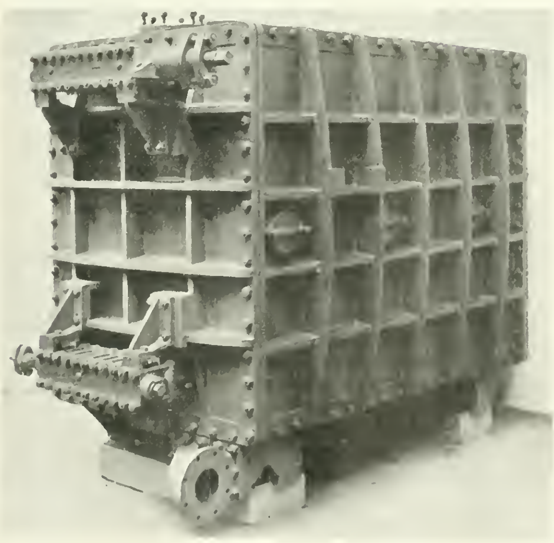


Fig. 1

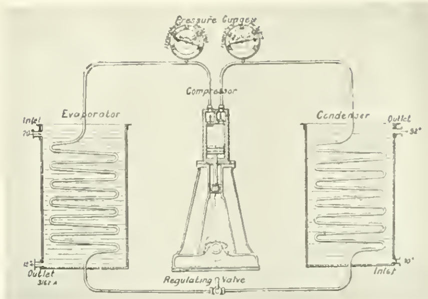


Fig. 2.

2. A Compressor, in which the CO_2 is recompressed to such a pressure as may be required to liquify it at the temperature of the cooling water available.

3. And a Condenser, Fig. 1. which, like the Evaporator, consists of lengths of pipe, containing the CO_2, and outside of which circulates the cooling water, which carries away the latent heat given out during liquefaction.

4. The Regulating Valve, which is placed between the condenser and the evaporator, for adjusting the quantity of liquid CO_2 passing from the condenser.

The general arrangement is shown in diagrammatic form in Fig. 2.

The installation comprises a large horizontal direct-acting compound surface condensing steam engine, the steam condenser being in the bed of the machine. There are two CO_2 Evaporators, two Compressors and two CO_2 Condensers, also four independent brine pumps for brine circulation, and a large independent duplex pump for circulating the sea water through the CO_2 condensers.

The machinery is placed between the two lines of shafting just aft of the thrust blocks on the engine-room bottom platform, and occupies very little space, which is of the utmost importance in marine work, where space is necessarily very limited. The machine is of the Horizontal Duplex Marine type, and is designated by the makers as their No. 16 size, and deals with a total insulated space of about 107,600 cubic feet, including the ship's provision rooms.

The compressors, as will be seen from the illustration, Fig. 3, are at the back of the machine, and are driven by tail rods from the steam cylinders. They are arranged so that they can be run together on the same service, or they can be run on separate services, so

that each steam cylinder and its compressor form a separate machine, and it is needless to say that this feature is extremely useful should a breakdown occur, as the carriage of a valuable meat cargo entirely depends upon the running of the machine.

The working pressure varies from about 750 lbs. per square inch with cooling water at 50°F., to about 1,125 lbs. at 84°F., but owing to the small diameter of the parts subject to this pressure even in large machines, an ample margin of safety is secured. All the parts subjected to the CO_2 pressure are hydraulically tested to a pressure of 3,000 lbs. per square inch, and then again tested whilst immersed in warm water by air at 1,350 lbs. pressure, whereby any porosity would be immediately detected. In order to secure the highest efficiency, the compressors of the large machines are bored out of hard solid steel forgings, thus ensuring not merely ample strength, but a perfectly smooth bore and entire absence of porosity.

An ingenious safety valve device is fitted to the compressor to obviate the possibility of any excessive pressure occurring. Fig. 4. It consists of an ordinary spring-loaded valve, at the base of which is a thin copper disc, which is designed to burst at a pressure of about 1,950 lbs. per square inch. After the excessive pressure has been relieved, the spring closes the valve and prevents any serious escape of gas whilst the valves on the condenser and evaporator are being closed. Great care is exercised in the manufacture of these discs, so as to ensure their being of the correct strength, and every disc is tested by hydraulic pressure to 1,350 lbs. per square inch, and one in every twelve discs is burst and the pressure carefully recorded.

This safety valve is necessary, as, in order to enable the compressor to be opened up for examination without loss of CO_2, it is necessary to fit a stop valve on the suction and delivery sides, so as to confine the gas to the condenser and evaporator, and should the machine be carelessly started without having previously opened the delivery valve, an excessive pressure would be created in the delivery pipe, which might cause the rupture of some part.

The compressor suction and delivery valves are all of the same design and interchangeable. The piston is packed with cup leathers similarly to the ram in a hydraulic press, and this absolutely prevents any leakage from one side of the piston to the other.

The piston rod gland is also packed by means of cup leathers and special oil under pressure, which is forced between the leathers, thus keeping them tight against the rod and sides of the gland. An oil pressure superior to the CO_2 pressure in the compressor is maintained on the oil by means of a patent differential piston, one side of which is in connection with the CO_2 gas at the condenser pressure, and the other in contact with the oil. On the side which is acted on by the oil is a piston rod, which is carried through the cylinder cover and supported in a guide. As the area of the piston in contact with the CO_2 is greater than that in contact with the oil by the area of the piston rod, a superior pressure per square inch is maintained on the latter than the former. The oil chamber is connected to the compressor gland by a pipe, and as any oil leaks past the cup leathers into the compressor or atmosphere, the oil piston moves outwards, and after some hours' working the piston is pumped back by a few strokes of the hand-pump, which forces more oil into the chamber.

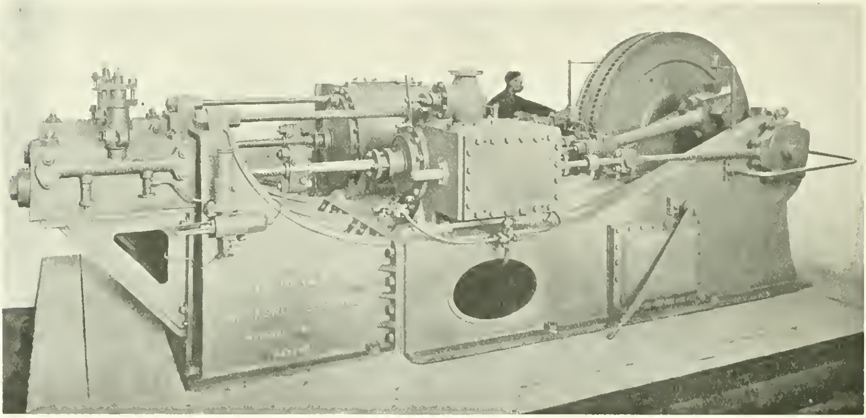


Fig. 3.

The position of the end of the piston rod in relation to the guide affords a ready means of ascertaining how much oil is in the chamber, and thus shows the attendant at a glance when more oil is necessary. A small leakage into the compressor is an advantage, as it lubricates the piston and fills up the clearance spaces in the compressor, thus adding to its efficiency. The gas leaving the compressor carries with it some of the surplus oil which is caught in a separator fitted on the delivery pipe to the condenser. The gas, on

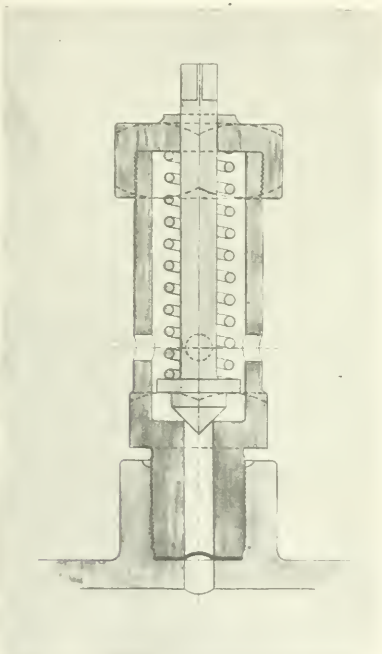


Fig 4

entering the separator, impinges on the walls of the vessel, and the oil adheres and drains to the bottom, where it is drawn off. Meanwhile the gas enters the condenser, passing from the separator through an opening at the top.

The CO_2 condenser coils are of solid drawn copper, for, unlike ammonia, CO_2 has no affinity for copper. The advantages of copper over iron, which is employed with ammonia, are obvious, for copper is not only a much better conductor of heat, but what is of more importance it is not corroded by sea water, whereas wrought iron, as all marine engineers are aware, is rapidly eaten away by the action of sea water, and even galvanizing is an uncertain protection. It is interesting here to point out that should a leakage occur in an ammonia condenser, the avidity with which the ammonia is absorbed by the circulating water would make it very difficult to locate the leak at sea, whereas a similar leak with CO_2 could be detected more promptly, and the defective coil blanked off.

It has been urged that CO_2 machinery cannot work successfully under conditions found in the tropics where the temperature of the sea water is high, but this is incorrect, as these vessels are for some considerable time during the voyage in tropical waters, where the sea water is often at a temperature af 85°F., but no difficulty is experienced, and they always land their refrigerated cargo in splendid condition. The compactness of the CO_2 machinery makes it especially suitable for marine work where space is very limited, and as the gas is harmless to human life, any escape is not attended with danger, and with the safety valve already described any serious accident is practically impossible.

The insulation of the various cargo and provision rooms is effected by means of silicate cotton, and tongued and grooved boards; between the layers of boards, special rot and damp-proof paper is inserted, and the woodwork is then well varnished. The electrically-welded galvanized brine grids are fixed to the overheading and sides of the chambers, and present ample surface to maintain the requisite temperatures necessary for the carriage of both chilled and frozen produce.

The brine circuits are arranged for warm and cold brine circulation for chilled and frozen produce respectively. The galvanized meat rails for the chilled meat are also carried on the overheading, and are secured in a very substantial manner to support the weight of the large consignments of chilled meat which these vessels bring from the River Plate. The doors in the provision rooms and trunk hatches are fitted with Taylor's patent galvanized hinges and fastenings, and the provision rooms are arranged for the separate storage of the various descriptions of perishable foods. An ice-making tank, water and wine coolers and cupboard coolers are also fitted in accordance with the most approved practice for large passenger vessels of the highest class.

Institute of Marine Engineers. At the Institute of Marine Engineers, on Friday, October 11th, the first Bohemian concert of the autumn session was held on the invitation of Messrs. J. Adamson and F. Cooper and proved an unqualified success, auguring well for a continuation of the popularity which has attended these gatherings since their institution. Mr. W. Lawrie, chairman of council, presided over an appreciative audience, which filled the lecture hall to its utmost limit. The programme included pianoforte solos by Miss Jessie Baynes, songs by Miss Elsie Savage, Madame Lena Michelbacker, Mr. Charles Veness and Mr. Walter Mason, and humorous selections by Mr. Percy Camilleri. During the interval, refreshments were handed round. After votes of thanks had been accorded to those responsible for the successful issue of the evening, the concert concluded with the singing of "Auld Lang Syne" and "God save the King."

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

Output of Tonnage.—The Scottish shipbuilding output for the nine months ending with September, amounted to 423 vessels of 499,850 tons gross. The output for the corresponding nine months of 1906 consisted of 318 vessels of 499,610 tons. While therefore, the tonnage for the nine months period of 1907 is only slightly larger than the figure for 1906, the number of vessels is much larger. This is accounted for mostly by the numerous small fishing craft built this year at East of Scotland ports. On the Clyde alone, the output for September consisted of 30 vessels of 37,270 tons, making a nine months' total of 269 vessels of 458,350 tons, as compared with 231 vessels of 462,277 tons last year. Here, also, the number of vessels is larger, and the tonnage smaller, making a lower average. This is accounted for by the production last year of such huge steamships as the *Lusitania*, the *Agamemnon*, etc., and by the fact that on the Clyde this year a much greater number of small vessels of the coasting and fishing order have been turned out. The average tonnage of the vessels launched in September on the Clyde was 1242 tons, and of these on the East Coast districts only 954 tons.

New Work.—While the output has gone on apace during the nine months, there has not been the amount of fresh work contracted for to balance the depletion of stocks. During July, August and September, the output amounted to 173,860 tons, but the fresh work booked during that period only approximated to 110,000 tons. The scarcity of new orders during September has been very marked, these hardly totalling 18,000 tons. There is no doubt, however, that had it not been for the labour cloud and the threatened lock-out, that hung over the shipyards for some time—but happily now dissipated—the prospects for the winter would have been better. In spite of repeated reports as to very substantial orders having been received, a number of the larger yards on the upper and middle reaches of the Clyde are still conspicuously scant of work on the stocks.

While the shipyards of Greenock and Port Glasgow are better off in the matter of work on hand than the larger number of the yards on the upper reaches, short time arrangements are being instituted there earlier than usual on account of scarcity of contracts. Intimation has been made that the men in Scott's shipbuilding yard and engineering establishment at Greenock are to be put on short time. The new arrangement, under which the hours will be reduced from fifty four to forty-four per week, comes into force to-morrow. A slight curtailment of the hours of labour is also to be made in the case of the employees of the Greenock and Grangemouth Dockyard Co. and if the outlook does not improve a further reduction is probable. Fortunately, there is a large amount of work in hand in the shipbuilding and engineering yards of Messrs. Caird & Co. The first to be delivered of the three Peninsular and Oriental boats, recently ordered from this firm will be the *Salsette*, which is intended for service between Aden and Bombay with mails. She is expected to be ready in February or March. The other two vessels are considerably larger, and will have a higher speed.

Down to the time of writing—the 22nd October—the only orders of any great importance reported as having been booked by Clyde builders during October are three in number. The Fairfield Co. Govan, have been commissioned by the Canadian Pacific Railway Co. to build and engine a steamer [illegible] ft. in length for the service between Vancouver and Victoria. The new ship will be an improvement on the *Princess Victoria* built in 1903 for the same Company by Messrs. Swan & Hunter of Wallsend-on-Tyne. Messrs. Alex. Stephen & Sons of Govan have received from Messrs. Elder, Dempster & Co. an order for a twin-screw steamer of 12 knots speed for the West African and West Indian trade; two similar vessels having also been ordered from Messrs. Harland and Wolff, Belfast. Messrs. Ferguson Brothers Port Glasgow, have received an order for a powerful bucket dredger for India.

Fairfield-built Turbine Steamers.—The Fairfield Co. are putting the finishing touches to the three-screw turbine steamer *Heliopolis* for the Egyptian Mail Steamship Co., and she will be taken out for speed trials early next month, while her sister ship the *Cairo* will not be very far behind. The advent in the arena of service of the first-named vessel, on December 7th, will mark a new era in British steamship enterprise on the Mediterranean. On the date stated, the *Heliopolis* will commence the runs which are to reduce the journey from London to Cairo to a four days' trip, the new vessel contributing to that end by a fast service between Marseilles and Alexandria and *vice versa*. The new vessels are 525 ft. in length, 60 ft. in breadth and their propulsive machinery consists of three ahead turbines on three lines of shafting, which are designed to give the vessels a speed on service of 18½ knots. They have each accommodation for 500 first-class and 280 second-class passengers, and in the saloon and state-room arrangements and appointments they reproduce all the best features of the newest Atlantic liners. The turbines for these splendid vessels have, of course, been made by the Fairfield Company themselves and they are of the Parsons type, embodying modifications which the engineering designers and management at Fairfield have evolved from their experience with the turbine machinery already produced. Previous turbine steamers built by the Fairfield Company were the yacht *Narcissus* in 1904 (the first turbine vessel built having twin-screws); the cross-channel steamer *Dieppe*, in 1905; and the Burns' Irish Channel steamer *Viper*, launched in April of last year and just recently taken off the Belfast daylight service, after a highly successful season's runnings. The two new Egyptian mail steamers run the list up to five for which the Fairfield Company have made turbine machinery. The turbines in their case are to run at about 340 revolutions per minute, a rate which necessitates as small a diameter of propeller as prudence would allow. Everything has been done that appeared possible to favour the efficiency of the turbine and reduce the weight of machinery. The boiler power is increased six per cent. above what would be allowed for reciprocating machinery of equal power, and the gross weight of engines, boilers and auxiliaries works out about 400 tons lighter for the turbines. The space occupied by the boilers and machinery is practically the same, but the cost is greater. A large consumption of coal, with corresponding increase of bunker capacity, has been allowed for, and it remains to be seen how the consumption will work out.

New Shipbuilding Machine Tools.—The manipulation of steel in the cold state—that is, without furnacing—for the structural features of ships has made great progress within the last few years, and many things point to its further development, the saving of time and labour in this direction being, of course, immense. Roller-bending machines of a type designed by Mr. Nicol S. Arthur, engineer, Glasgow—whose ship frame-bevelling machine is so well-known in all important shipyards—are now being adopted in a number of the largest shipbuilding establishments to deal with the bending or straightening of beams and other bars without being heated. At the Beardmore Works, Dalmuir, one of these bending machines has been installed for considerably over a year, and accomplished highly important work in bending and straightening the beams and other bars entering into the structure of the battleship *Agamemnon*. With a similar machine elsewhere ship frames themselves have been curved in the cold state to form the round of bilge. There has also recently been installed a bending machine of this type and of the very largest calibre in the works of Messrs. Vickers, Sons & Maxim, Barrow-in-Furness, with which not only heavy deck beams, but light angles and "T" bars for ships' framing, etc. have been bent cold to very small radii, and with surprising despatch. The makers of this type of machine are Messrs. Smith Bros. & Co. Ltd., Kinning Park, Glasgow.

Institution of Engineers and Shipbuilders.—The opening meeting of the fifty-first session of the Institute of Engineers and Shipbuilders in Scotland was held on the 22nd inst. in the Institution Rooms, Glasgow, when the new president, Mr. John Ward of Messrs. Denny & Bros., Dumbarton, delivered his presidential address, which dealt for most part in a retrospective way with the developments in shipbuilding. A very full abstract of this elaborate address is begun on another page of this issue. A paper was also submitted to this meeting, descriptive of an "Apparatus for Extinguishing the Rolling of Ships," the author being Dr. Victor Cremieu,

of Paris, who has already contributed a paper on the subject to the Académie des Sciences, Paris. The programme of papers to be read during the rest of the session is one of decided interest and variety and reflects credit on the secretary of the Institute, Mr. E. H. Parker. "The Place of the Laboratory in the Training of Engineers" is the title of a paper to be given by Professor A. L. Mellanby, which will be followed by one on the up-to-date subject of "Wireless Telegraphy," by J. Erskine-Murray, D.Sc. Mr. W. C. Martin of the electrical firm of Messrs. W. C. Martin & Co., will give an elaborate paper on "the Electrical Equipment of the T.S.S. *Mauretania*," the work connected with which his firm has been responsible for. "The Inter-relation of Theory and Practice in Shipbuilding" is the title of a paper which will be delivered by Mr. J. J. O'Neil, of the Scientific Staff at the Fairfield Works, while the subject of "Ships' Specifications," more particularly with regard to their commercial aspects, will be treated of by Mr. J. R. Jack, of the designing staff in Messrs. Denny's shipyard, Dumbarton. Mr. I. V. Robinson, agent for Messrs. Richardson, Westgarth & Co., West Hartlepool, will submit a paper on "The Cost of Power Production," while Mr. D. B. Morrison, of the same firm, well-known as a contributor to the transactions of engineering societies and of high repute as an ingenious engineering inventor, will read a paper on "Condensers and Condensing Plant." Danish "State Railway Ferry Steamers" will form the subject of a paper by Mr. H. N. Olsen, and as the general question of train ferry steamers for cross-channel and cross-river purposes is at the present time being much canvassed, the paper should be of special interest.

The session just inaugurated is the fifty-first in the Institution's history, the jubilee year having been marked in various ways. The Institution's fine new premises in Elmbank Street, opposite the High School, is making good progress and by this time next year, at latest, the Institution will be completely installed in its commodious new premises. For some time past, the well-known photographic firm of Lafayette, Ltd., have been securing "sittings" from members of the Institution, which altogether now is some 1550 strong, and they are preparing large-sized panel groups of the members' likenesses, arranged artistically in a manner having regard to the various professional branches of which the whole membership is composed. This artistic undertaking, for which Messrs. Lafayette are entirely responsible, is being rapidly proceeded with and the first fruits will no doubt enrich the walls of the Institution's new home in Elmbank Street.

Rosyth Naval Base.—The Admiralty have recently placed an order with a local ship-carpentry firm for the construction of a heavy barge for boring purposes at Rosyth Base, this making the fifth to be supplied. The representatives of the Admiralty at the site look forward to a definite start being made with constructional work early in the coming year. It is stated that an initial sum of £1,000,000 will be included in next year's Navy Estimates for progress with the works, and that early in the year nearly 1000 men will be employed. Sir John Jackson, Ltd., have recently received instructions to sink the trial concrete cylinder caisson 10 ft. deeper than it has presently reached—*viz.*, 72 ft.—for the purpose of proving the depth of the strata of boulder clay, which was met at about 60 ft. below present surface level. It has been decided to proceed with constructional work on the cement concrete monolith principle, the intention meantime being to proceed with a sea-wall, a wet basin and graving dock.

THE TYNE.

(*From our Own Correspondent.*)

Departure of the S.S. Mauretania.—By the time these lines are in print, the great Cunard liner that has been the object of such interest of late, will have taken her departure from the Tyne, and this will doubtless be her final departure; for no conjunction of circumstances is ever likely to arise that will have the effect of bringing this notable vessel back to the river that has had the distinction of giving her birth. In her journey to Liverpool, the *Mauretania* will steam round the North of Scotland, which route is doubtless considered to be the safest; whilst going round no attempt at speed tests will be made. During the public inspection days that were instituted by the builders, with the view of letting all interested see what can be done now-a-days in ship equipment, and also with the laudable purpose of helping local charities, large numbers of people paid for seeing through the vessel, and it is understood that the charitable institutions that are to share in the proceeds will be substantially benefited. The departure of this vessel will doubtless have the effect of throwing men out of employment; but we are pleased to note that the firm have a good share of other work in hand, which can now be pressed forward with augmented vigour.

Strikes and Rumours of Strikes.—It is being dinned in our ears every day by the Metropolitan and provincial press, that a great railway strike is imminent, and this, should it take place, would, as all know, ruinously affect the ship-building and engineering trades, as well as other industries. We are not among those who greatly fear the occurrence of such a disaster, as we think the men in the railway service, who have comfortable situations, and will not lightly throw them up, are numerous enough to comprise the large majority. The boilermakers have succeeded in keeping "on terms" with the employers by resorting to their customary policy of "climbing down," when confronted with unbending firmness. In their current monthly report, reference is made to a special fund to be created, ostensibly for fighting purposes, or the preservation of their "hard-won rights." This is indicative of no peaceful spirit, and it is to be feared that under the existing régime, the Boilermakers' Society is not the politic organization it was reputed to have been some ten or a dozen years ago.

The Shipbuilding Outlook.—Apart from our own view of the shipbuilding outlook, which is not hopeful, we are assured by a principal in a well-known Tyne yard that, owing to the high prices of material, it is almost impossible to secure fresh work to replace completed orders, at any thing like remunerative prices, and the future is consequently not very bright. The employers could, of course, relieve the strain a little by enforcing a general reduction of wages; but so far they have not indicated any intention of doing so. This, we think, is a proof of singular moderation on the part of the employers; for no one can doubt but that at this moment little opposition would be offered to a wages reduction, if such were called for.

Work on the Stocks.—At both the Elswick and Low Walker yards of Messrs. Armstrong, Whitworth & Co. the majority of the berths are occupied and business is consequently fairly brisk. Messrs. Hawthorn, Leslie & Co. have a couple of large vessels in advanced stages, and have also some torpedo destroyers in hand. In the graving dock there is a repair contract in progress, and it is understood that the dock will be occupied by another large vessel, requiring an overhaul, some time in November.

Messrs. Wood, Skinner & Co., have three vessels in various stages on the stocks, and arrangements are being made for placing a keel in a fourth berth, from which a vessel was launched recently. Although the trade outlook generally is not encouraging, it is satisfactory to note that in this and some other instances there is a prospect of steady work being maintained for some months yet. The Smiths Dock Co. have a large amount of repair work in hand and have also some new work on the stocks.

Messrs. Robert Stephenson & Co's large graving dock has recently been occupied by the Anglo-American oil tank steamer *Narragansett*, which received an extensive overhaul. The Prince liner *Afghan Prince* has also been repaired by the firm. The dock will shortly be occupied by H.M.S. *Lord Nelson*, for painting, etc., preparatory to trials.

State of the Engineering Trade.—It is indisputable that there is now a marked falling-off of business at most of the leading marine engine works, and, in some instances, night work has been discontinued or curtailed. The North-Eastern Engineering Co. have secured a very large proportion of such orders as have been in the market lately, and the result is seen in a continuance of briskness, both at their Wallsend and their Sunderland establishments. The recent completion of some heavy contracts has somewhat lightened the pressure at the Wallsend Slipway Co.'s works; but, we hear there are still some good contracts in hand, and it is hoped that these will soon be supplemented by others. The engineering works at Shields that are largely engaged in repair work, are generally keeping pretty busy, and the corrugated packing works of Messrs. Newton & Nicholson, Tyne Docks continue to be well employed. Ironfoundries at this centre are finding it difficult to secure new orders, and discharges of hands are

taking place weekly. In the brass-fitting and copper-smithing shops business has also fallen off considerably. Timber imports at Tyne Dock have been but very meagre during the past couple of weeks, and the number of unemployed workmen has been largely increased.

We understand that Messrs. Holzapfel's Manufacturing Works, Heworth Shore, are busy in all departments, the demand for their specialities in protective paints and compositions for ships having shown a further large increase during the past few months.

The boiler-covering works of Messrs. S. T. Taylor & Sons, Scotswood (the "Tynos" Works), are also showing undiminished activity, the firm's well-known asbestos removable mattresses, being more than ever favoured by shipowners, as affording the requisite protection to boiler shells and being easily applied.

THE WEAR.

(*From our Own Correspondent.*)

Trade still declining.—In connection with the shipbuilding industry in this district, the only cheering incident to be noted this month is the announcement that Messrs. Priestman and Co. have booked an order for a large cargo boat, the construction of which will be proceeded with immediately. There may have been other orders received, of course but if such has been the case, the fact has not transpired. Several launches have taken place during the month; but only in one instance has a keel been placed in the vacated berths. After a period of considerable briskness, the Southwick yard of Messrs. Robert Thompson & Sons is now very slack, and the staff of hands has necessarily had to be reduced. Southwick was at one time a busy centre of sheet glass and earthenware manufacture; but, besides shipbuilding and marine engine construction, little means of employment now remains, and when these latter industries are depressed, as is now the case, the outlook is gloomy indeed.

H.M.S. "Cyclops."—This vessel, which has been built and equipped by Sir James Laing & Sons, as a floating workshop, to the order of the Admiralty, has been for a few days open to public inspection, and has been visited by a large number of persons. A charge for admission was made, and the proceeds will, it is understood, be divided amongst local charitable institutions. The machinery equipment, which is very extensive, will be actuated by electricity and the whole of the electrical apparatus has been installed by the Sunderland Forge and Engineering Co., Ltd. It is understood that the vessel is now quite completed, and will be sent round to Devonport in the course of a few days to be delivered to the Admiralty representatives.

The Engine Shops.—The Scotia Works and the North-Eastern Marine Works still maintain an appearance of briskness, although even in these, the busiest of the local engineering establishments, signs of incipient slackness are not wholly absent.

The Blyth Shipbuilding and Dry Dock Co. appear to be getting a good share of repair work, among recent contracts received being the overhauling of the s.s. *South Australia*, of London, and the repairing of the Glasgow steamer *Ravensheugh*.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

Mersey Dock Board.—The Mersey Dock Board have resolved to spend £24,000 in deepening the river opposite the Brunswick Docks. The treasurer in his statement for the year ending the 1st of July, states that the receipts on revenue account amounted to £1,792,182, and the expenditure to £1,659,620, leaving a balance of £132,561, of which £100,000 was carried to sinking fund and the balance to the unappropriated receipts account, which now stands with £362,429 to its credit.

Manchester Chamber of Commerce.—The directors of the Manchester Chamber of Commerce have welcomed the formation of the Manchester Association of Importers and Exporters, and do not consider that the work of the Association will interfere with the functions of the Chamber, but rather that the two can be of assistance to each other.

Ship Canal Finances.—The revenue of the Manchester Ship Canal for August amounted to £45,246, compared with £43,710 in August last year. The receipts for the eight months of the year were £335,514, as against £315,693 in 1906.

Oil.—The largest cargo of oil yet imported to Manchester arrived recently. It reached 6800 tons, or about one and three-quarter millions of gallons. The bulk of the oil was for the Manchester Corporation.

Concrete Novelty.—A novelty in dock construction has just been introduced into the Manchester Ship Canal by Mr. W. H. Hunter, M.I.C.E. The caissons for the extension of the Central Pier of the lock at Irlam have been built of reinforced concrete in blocks weighing 100 tons, and safely deposited in position.

Mr. Lloyd-George.—The President of the Board of Trade, during his visit to Manchester about a fortnight ago, took advantage of the invitation of the Manchester Ship Canal Co. to visit the docks. The tug *Eccles* was placed at his disposal. Accompanying him were Mr. Alf. Emmott, M.P., Deputy Speaker of the House of Commons, Lord Brassey, Mr. W. J. Crossley, M.P., Mr. Llewellyn Smith, C.B. (permanent secretary to the Board of Trade); the Hon. N. M. Farrer, Board of Trade expert on shipping matters; Mr. A. K. Bythell (chairman of the Ship Canal Co.); Mr. Hunter, chief engineer of the Ship Canal Co., and a number of city aldermen and officials. Over two hours were spent in an inspection of the docks, warehouses, grain elevators, foreign animals' wharf, cold-air stores, the Barton acqueduct, etc. Mr. Lloyd-George, before leaving for London, said he "had been perfectly amazed to see such a great port carved out of the solid."

Yarn Exports.—During September our exports of yarn were 20,057,700 lbs., against 16,057,400 lbs. in September, 1906. Germany and Holland are buying much more freely, in fact, Germany has doubled her purchases in one year. Egypt and Turkey show a falling off, and India has not taken so largely as in 1906.

The Timber Trade.—The timber trade has been of a moderate character here during the last two months. Imports have been on a smaller scale all round, with a consequent increase in stocks. Values continue fairly steady, but it is suggested that a curtailment in consignments would be beneficial to the home trade. The stocks at Manchester Docks at the beginning of the month were as follows:—Hewn pitch pine, 5000 cubic feet; sawn pitch pine, 487,000 cubic ft.; pitch pine planks, 14,000 cubic ft.; Quebec board pine, 387,000 cubic ft.; birch logs 17,000 cubic ft.; birch planks, 214,000 cubic ft.; spruce deals, 23,729 standards; pine deals, 1700 standards; Baltic red and white deals, 9350 standards; Baltic flooring, 2330 standards; Galatz, etc., whitewood, 3910 standards; Canadian and U.S.A. oak, 1000 cubic ft.

British Textile Machinery Exports.—There was a further expansion in the value of our textile machinery exports during September as compared with September last year. The total value in September this year was £652,307. Last year the September returns were valued at £538,668, nearly £100,000 in excess of the value of the exports in September, 1905. For the first nine months of the present year British textile machinists shipped abroad to the value of £5,877,629, being over a million in value compared with the returns for the same period in 1906. During September this year the goods shipped to various countries were in the following proportions:—Russia, £25,028; Germany, £103,855; Netherlands, £15,343; France, £62,863; other countries in Europe, £143,011; China, including Hong Kong, £3201; Japan, £57,910; U.S.A., £37,706; countries in South America, £34,418; British India, £147,462; Australia, £1464; other countries, £19,923. Japan and South America, all things considered, are the most notable features in the returns.

Portland Stone.—For some time past large consignments of Portland stone direct from the quarries have been landed at the Manchester docks. Some of the blocks of stone weighed 12 tons. These were lifted from the hold by cranes and deposited on lurries in readiness for them and carted straight to the site of the new Infirmary in Oxford Road, now in course of erection. Between 15,000 and 20,000 tons of Portland stone are required for the new hospital, and it is found that the transit of the material by sea and canal effects a great saving, as compared with railway transit.

Trafford Park.—Machinists are finding that Trafford Park,

owing to its close contiguity to the Manchester Ship Canal, is a suitable place for sites for their works.' Messrs. Taylor Bros., of Leeds, makers of railway wheels and axles, have purchased a site, and are erecting a factory which is near completion. Owens Bottle Co., after searching about Europe for a year for a suitable place, finally dropped on Trafford Park, and are erecting the largest glass bottle factory, perhaps, in the world. Owens is an American company, anxious, we understand, to compete with Germany. Another company which makes paper is erecting a strawboard and glazed-paper mill, their chief object being to compete with the paper now brought from Norway and Sweden.

Thos. Duxbury.—There is no man more notable in connection with our increasing exports of gas and steam coal than Mr. Thos. Duxbury, A.M.I.C.E., F.C.S., etc. He has been all his life mixed up with gasworks and gas coal and gas lighting. He is a native of Darwen, where he received his baptism in gas and coal, and now is a large exporter of gas and steam coal. The opening of the Ship Canal stimulated his energies. His operations extend to all parts of the kingdom and to many foreign ports. A fleet of steamers is constantly under charter to him. Mr. Duxbury is an able and interesting lecturer on gas and its by-products.

Ironworkers' Unity.—The scheme for unity among the iron and brass workers' industries has just been completed. The trade union organizations represented in the new federation are the Ironfounders' Society, the Associated Ironmoulders of Scotland, Central Ironmoulders of Scotland, Welsh Ironfounders, Plate and Machine Moulders, Scottish Brass Moulders' Union, North of England Brass Moulders, Journeyman Brass Founders' Society, Amalgamated Brassworkers and Metal Mechanics, Core Makers and National Stove Grate Workers. There is an aggregate membership of 50,000 trade unionists. The chief object of the combination is to prevent the clashing of interests and the consolidation of any action taken on behalf of the workers in their relations with their employers.

Shot in Salford Docks.—A native of the Isle of Man named Wm. Cunningham, 5th engineer of the *Bostonian*, was sitting in the boatswain's cabin in Salford Docks early in the month when the boatswain, Walter Bendig, opened a parcel which he had received from Antwerp, in which he expected to find a revolver. Several other men were in the cabin at the time. At first his search was unsuccessful, but ultimately the firearm was found wrapped in paper in the pocket of an overcoat. Taking it out he was handling the weapon, when one of the chambers, which happened to be loaded, exploded, and Cunningham was shot dead. At the inquest a verdict of "death from misadventure" was returned.

Lancashire Iron Trade.—During the last month or six weeks there has been a slow but regular decline in the prices of pig iron and hematites. Buyers have refrained from buying more than just sufficient to meet present requirements. The same hesitancy is characteristic of users of copper, tin and allied metals. Some of our local brass founders have suffered losses through the rapid fall in copper. Stocks which had cost, say, £70 per ton, fell to £60 within a fortnight. It has been a ticklish time for both brass and iron founders. The only steadiness in values relates to manufactured iron, which has shown little variation. Foreign irons, both pig and manufactured, are now freely on offer at our market at prices much below English prices, and this must have a dragging effect on them. Average quotations are as follows:—Scotch metal, delivered Manchester docks: Eglinton, 67s. 6d.; Dalmellington, 67s.; Glengarnock, 70s. 6d.; Gartsherrie, 71s. If delivered at Heysham or Fleetwood there is a reduction of 2s. 3d. per ton, and if landed at Preston a less charge of 1s. per ton. Middlesboro', G.M.B., 62s. 6d.; Derbyshire, 61s. 6d.; Staffordshire, 57s. 6d.; Lincolnshire irons, which have been twice recently officially reduced, now stand at 61s. 6d. for No. 3 and foundry and 59s. for forge, all delivered here; Derbyshire forge metal, 58s.; hematites, East Coast, 76s. 6d., do. west coast, 74s.; scrap iron, 55s. to 60s. per ton; billets, foreign, £5 7s. 6d.; English, £5 17s. 6d.s to £6 and upwards. Manufactured iron prices are about the same as last month's list, changes being so slight as not to require amending. The outlook in the iron trade is not particularly briliant, but our textile machinists and general engineers have sufficient orders in hand to keep them well employed during the present winter months.

Lancashire Coal Trade.—The Lancashire coal trade continues on a satisfactory basis so far as coalowners are concerned. The chief demand is for steam coal, which is now becoming scarce. Fortified by the high prices prevailing, the operative miners have applied for a further advance of 5 per cent. in wages, making the fourth this year. Three advances have been secured, and the fourth came before the Coal Conciliation Board in London on the 15th inst., when the parties could not agree, and Lord James of Hereford was called upon to act as referee. During the latter part of the month there was a slight falling off in the demand for shipping and house coal, but there has been no change in prices. The list of average quotations which appeared in out last issue still holds good. Some of the higher qualities of house coal are fetching still better prices. What with higher wages, possible railway troubles, and a good foreign demand, the time is apparently far off when coal will be any cheaper.

THAMES.

(From our Own Correspondent.)

Engineering at the Olympia Exhibition.—Nothing in this district in the past month has equalled in importance the display brought together under one roof at West Kensington. The fêting that began and ended it was perhaps only natural in view of the success attained. The large floor was replete with machinery in motion, and as it should be we think, the novelties were in evideuce. People do not go to exhibitions to see something they are already familiar with. They ask to have the eye and mind interested, and that this was the case in this instance there can be no doubt. There was a great diversity in the exhibits. Design and workmanship combine in the present day and there was ample evidence of this in what we saw. We think also there was a more general representation of engineering in all its branches than has previously been the case. Machine tools are still a leading feature and these are in every variety with many of foreign make. Electricity is to the front also, especially for driving hoists. Compressed air claims attention for use in pneumatic machines and also for war service for torpedoes in the Navy. Lectures were made a feature and were a considerable attraction in some cases, as those that the Marine Engineers held clearly testify. The Exhibition remained open from September 19th to October 19th.

The Engineer-in-Chief to the Navy.—The retirement of Sir John Durston from his position at the Admiralty has definitely taken place. This has been for some time indicated, Sir John having been on the retired list of the Navy and retained specially in his position, showing, therefore, the value set on his services. The changes have been many in the long period the late holder of this office has served. Steam has been perfected, till we see it what it is to-day in such vessels as the *Dreadnought* and *Lusitania*. It may safely be said that the late Chief Engineer to the Navy carries the best wishes of all those with whom he has come in contact during a most successful career.

Mail S.S. Lines.—The Royal Mail Line have held a special meeting for the purpose of creating new debenture stock. These debentures are to pay off existing ones falling due, and an issue of £1,000,000 was necessary. £500,000 of this falls due on January 1st, and the balance is available for meeting the steady expansion in the company's business. It was proposed and carried to issue two-thirds of the Company's capital as debenture stock at such times as it was thought expedient. The interim dividend declared by the Shaw Savill and Albion Co., Ltd. was at the rate of 5 per cent. per annum for the half-year ending June 30th on the preference and ordinary stock of the company.

Thames Steamboat Service.—At a recent meeting of the London County Council, the inevitable question of the continuance of the service again came up for discussion on a question as to the possible sale of some of the boats. Even with every attempt to economise, the loss continues. There is no traffic for the boats, and with the winter upon us there is naturally less likelihood of success than in the summer. Evidently a permanent reduction in the number of boats is being considered, but nothing has yet been decided upon.

Engineering Work.—It is notified that the Thames Engineering Co., of Greenwich and Blackwall, has secured a contract for £50,000 from the Metropolitan Water Board for the construction of engines and boilers for the new reservoir at Walton-on-Thames.

Ocean-going Training Ship.—The *Port Jackson* has left the Thames on another voyage to Australia with boys from the *Warspite* and cadets under London County Council auspices, sent by what is known as the Brassey scheme. The vessel will, under favourable circumstances, reach Sydney before the end of the year and return here towards the late spring.

Trinity House Appointment.—This body has given the vacancy of Superintendent of the South-Eastern district, which extends from Portland to Ramsgate and comprises the supervision of eleven lighthouses and thirteen lightships, to Captain Lee, the late commander of the Trinity yacht *Irene*. The district is nearly 200 miles long and the head-quarters is East Cowes.

Finsbury Technical College.—The Lord Mayor attended in state to open a new wing of this College, and on the occasion many well-known men attended, including Sir J. W. Barry, Sir W. White, Mr. Yarrow, Sir Edward Clarke, Sir Alexander Kennedy and Sir P. Magnus. The Lord Mayor gave sound advice to the students, and his presence indicated his interest in the cause of education and the general well-being of those he addressed.

St. Paul's Annual National Service for Sailors.—The third service of the kind has been held in St. Paul's Cathedral, at which representatives of the Royal Navy, the Mercantile Marine and Royal Naval Reserve, Trinity House and others connected with the service attended, when the Ven. Archdeacon Wood, Chaplain of the Fleet, preached. This service commands always a good deal of attention, owing to the interest that the nation takes in its sailors, and the cathedral is a fitting and proper place for such a service to be held.

The Shipping Exchange Fountain.—There has recently been a presentation of a fountain to this building in St. Mary Axe. The bronze was ceremoniously unveiled and is said to be a work of art. It represents a life-size figure supporting a boat symbolic of the *Baltic*. The fountain was much admired this year when it was shown at the Royal Academy, and will be an adornment to the fine building it is set in.

National Harbour at Dover.—This great work, which has been in hand for eleven years, is nearing completion. The cost has been three-and-a-half millions sterling and over 600 acres of the harbour are enclosed, which is likely to prove a station for mail steamers, as well as a rendezvous for the Navy. As compared with other harbours enclosed, the following figures give some idea of comparison :— Portland is the largest with 72,00 acres. Then follows Colombo 660, Boulogne 650, Dover coming next. From the position of this port it is evident the great work will have its proper place in the future as far as shipping is concerned.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—No new orders have been booked by Barrow shipbuilders during the month, and the demand for new shipping tonnage is very quiet, and as nearly every shipyard of the country is in need of work, the competition for the few orders on offer is very keen. Indeed, prices at the moment are recognised to have reached a point at which it is impossible to build at a profit. This is not a satisfactory position for shipbuilders, and their employés are showing some apprehension lest, first of all, their services will not be required, and, secondly, the necessity which may possibly arise for cutting down wages so as to reduce the cost of construction. Vickers, Sons & Maxim have a fair number of orders in hand, but with the exception of the great Brazilian *Dreadnought*, they do not represent much tonnage, and Vickers' works have been built to deal principally with heavy tonnage, and more particularly with warships, orders for which have not been given out on a large scale for some time past, either for the Home Government or for foreign nations.

Growing Competition.—For a long time there has been strenuous competition for the lower class of tonnage, and serious competition has arisen in respect to orders for first-class ocean passenger steamships. It is now obvious that a growing competition has arisen in the business of warships, as several firms throughout the country have now brought their works up-to-date, and have equipped them with the most modern machinery in order to undertake the largest and smallest orders for warships. In this sense the Vickers' Company have taken the lead, and have shown more enterprise and courage and have expended more capital than any other firm in order to bring into existence the most perfect up-to-date equipment. Mr. James Dunn, one of the directors of the Vickers' Company, spoke on this subject at the annual dinner given by the Mayor of Barrow (Mr. Councillor Butler), on the 14th of October. He emphasised the importance of keeping a great establishment like that of Vickers, Sons and Maxim in the most perfect and up-to-date position, because it was only by that means and by the economic and rapid production of work that orders could be obtained in the present state of competition. He said his directors would bring all the work to Barrow they could secure, and he cited the fact that during last year Vickers, Sons & Maxim had paid no less than £800,000 in wages to their workmen, outside altogether of salaries, as a proof of the importance of the undertaking to the town.

The Winter's Outlook.—The outlook for the winter is not an encouraging one, and it is not likely any heavy tonnage will be placed, although in cases where firms equip themselves for heavy warship construction, it is never known when business will turn up, especially as overtures and negotiations in reference to prospective vessels are always more or less receiving the attention of the expert staff. It seems now to be generally understood that Russia will place no more orders in this country, as reports are to hand that the work of building her new Navy will be confined to her own dockyards. The experience of the late war did not prove she was well served in this respect, but she may have gained experience by her defeat and be ready to guard against failure in the future. At any rate she will soon have a ship well up-to-date in her hands in the armoured cruiser *Rurik*, now completing at Barrow. She passed through her trials very satisfactorily and gained a higher speed than her contract specification. She has still to undergo some gun trials, but most of these weapons have already been tested with highly satisfactory results, and all that is needed now is to see that they work satisfactorily when in position on her gun mountings. The *Rurik* looks a formidable ship, and she is not only well armoured, but has a greater fighting effectiveness than any cruiser yet launched by any other power.

Battleship Construction.—The Brazilian battleship building at Barrow will be a monster. She is larger than the British *Dreadnought*, and possesses greater gun power, while her arrangements and economy enable her to have all her guns on either broadside or fore and aft. This feature has not been adopted on any battleship previously built, and it places the Brazilian Navy in the first position as regards the effectiveness of the two new battleships building in this country. The prospect is that before they are ready to proceed to South America other and more powerful vessels will have been designed, and orders placed for their construction. The evolution of the modern battleship is proceeding very quickly, and there is no doubt the immediate future has in store for us some developments which will be a surprise to the shipbuilding world.

Smaller Craft.—It is expected the three steamers building at Barrow for the London & North-Western Railway Company will be launched during November and December. They consist of a passenger steamer and two cargo steamers for the Holyhead and Dublin service, and have all the appearance of smart craft. They embody all the improvements of the day in channel-steamer construction. The work is proceeding satisfactorily with the Mexican transport ship, the first item of a new Mexican Navy. It is believed the action of Brazil in building two *Dreadnoughts* will be followed by the Argentine, Chilian, Uruguay, Peruvian and Mexican republics, but nothing has been decided on in this respect, although many rumours are in the air. The new turbine steamer building at Barrow for the Isle of Man Steam Packet Co. is engaging close attention, not only in the shipyard of Vickers, Sons & Maxim, but in the engineering shop. She has to steam at 25 knots an hour, and is being built to carry 2,500 passengers. It is fully expected she will more than achieve this performance. She is to be ready to go on her station next Whitsuntide.

West Cumberland.—No interruption in the general run of activity at the Workington and Maryport shipyards can be reported. The management of both concerns seem to be able to secure a continuity of small orders, and they are in a good position as regards work in hand, and have good prospects of orders to follow those now in hand.

Shipbuilding Material.—The demand for shipbuilding material has fallen off somewhat, and the plate mills have been working broken time, and are expected to maintain this state of things during the winter months. Heavy plates are at £7 7s. 6d. net each. A good trade has been done and is still doing in heavy steel castings for Belfast and the steel foundries are likely to be kept fairly busy.

Hæmatites.—The trade in hæmatite iron has gone off considerably. The demand is quiet and the business doing on foreign account is small. Prices are down at 71s. net cash sellers. Stocks are lower, about 8,265 tons.

Shipping.—There is a weaker tone in shipping. The aggregate exports of iron and steel this year have reached 709,720 tons, being an increase of 43,982 tons on the corresponding period of last year.

HARTLEPOOLS.

(From our Own Correspondent.)

Docks.—During the past few weeks an exceptional number of steamers and sailing vessels have arrived in the port bringing in large cargoes of timber and pit props, filling the quays and jetties, and necessitating the railway company to strain every effort to convey the timber away to make room for the ships awaiting their turn.

The Victoria Dock extensions are making great headway for handling large trucks of coals and bringing the old dock up to the latest requirements.

Shipbuilding.—It appears to be on the wane. Some of the slips will shortly be empty; although the yards at present present a fairly busy aspect there are but few orders for new ships. No doubt the high price of materials tends to keep orders for cargo vessels from being placed.

The settlement, or anticipation of such, of the shipbuilders' "lock out" has been much appreciated by all classes and trades.

Engineering.—The works are keeping fairly busy, but on looking ahead the new orders for machinery are very scarce.

SOUTHAMPTON.

(From our Own Correspondent.)

The White Star Liner "Suevic."—Work is proceeding rapidly on the salved after-portion of this vessel, which is in the Trafalgar Dry Dock here, and it is now ready to receive the new bow portion which was launched from the yard of Messrs. Harland & Wolff at Belfast on the 5th October last.

The mainmast has been lifted out by means of the powerful electric crane with which the dock is equipped, and which is capable of dealing with a weight of 50 tons at 87 feet radius, also the shell plates have been cut away and removed as far aft as the after bulkhead of No. 3 hold.

An interesting article will be found in this issue, giving photographs of the vessel during the various stages of the salvage operations. These operations constitute one of the most remarkable feats on record, both in the light of salvage and shipbuilding.

The ss. "Newstead."—This vessel as reported in our June notes, was brought to Southampton after having been aground. She was dry-docked to ascertain the nature and extent of the damage sustained, and it was found that the vessel required practically a new bottom, and it was estimated that the repairs would cost about £15,000. After undocking, the vessel was taken into the Inner Dock where she remained until September last. We now understand the vessel has been sold to a firm of ship repairers, and she left Southampton in tow of the London tug *Oceana*. The *Newstead* was owned by the Newcastle Steamship Company.

The T.B.D. "Tartar."—Messrs. J. I. Thornycroft & Co., of Woolston Works, are making rapid progress with the work of fitting out the turbine torpedo boat destroyer *Tartar*. This vessel, which is one of two building for H.M. Government by Messrs. Thornycroft, was launched in June last, and we gave a full description of the vessel in our August issue. The vessel is now being painted with the regulation colour, and will shortly run her trials, when it is anticipated that the contract speed of 33 knots will be easily maintained.

New Dock at Portsmouth.—It has been decided to construct a new dock at Portsmouth to accommodate vessels of the *Dreadnought* class. The present large dock can only be entered with difficulty and at the highest tides. The new dock, which will connect the main harbour with No. 4 basin, will be 900 feet long and 100 feet wide with a depth of water at ordinary spring tides of 35 feet.

The *Dreadnought* is 490 feet long by 82 feet beam, so that in the new dock there will be ample margin for the largest battleships built or contemplated.

This new dock was projected by the late Board of Admiralty after the *Dreadnought* was laid down, but since that time various alternative suggestions have been considered, and it was only recently that the plans were finally approved and the site chosen. The work is estimated to occupy three years, and the total cost of the dock and machinery is estimated at a million sterling. We understand that the contracts have not yet been placed.

The New Dock.—The contractors, Messrs. Topham, Jones & Railton, have now commenced operations on the site of the new wet dock which they are constructing for the London and South-Western Railway Company.

Offices have been erected near the Cold Storage buildings, and are now in occupation, and the work of erecting the other necessary buildings is in full swing. Consignments of plant are arriving at intervals, and altogether the work is well under way.

It is expected that in about twelve months' time the work will have reached its zenith, and probably about 1500 to 1600 men will then be employed. The work of excavation will for the most part be performed by steam navvies.

The docks at Gibraltar, which the contractors have completed, comprised a large wet dock, three dry docks and a small town of buildings. The first vessel of large size to dry dock was H.M.S. *King Edward VII.*

BELFAST.

(From our Own Correspondent.)

Work in Progress.—According to Lloyd's Returns for the quarter ending 30th September, there were then 22 vessels with an aggregate of 169,474 tons in hand at the Belfast shipyards, as compared with 18 vessels of 132,540 tons in the corresponding quarter of last year. Several orders of considerable importance have been booked during the past month or two, and a continuance of the present satisfactory state of trade may be looked for.

Messrs. Harland & Wolff.—Owing to a close succession of launches from the south end of the Queen's Island, this portion of Messrs. Harland & Wolff's yard presents a somewhat bare appearance, but fresh keels have been laid down, and in a few months' time activity will be more apparent. It is stated that the new vessel which this firm has on order for the Hamburg American line will have a tonnage of between 47,000 and 48,000, and that her length will be 700 feet and her beam 88 feet. According to an interview with Herr Ballin, published by a leading Vienna paper, it may be gathered that this vessel is not intended to compete with the new Cunarders in point of speed. The 5th of October was the date of the launch of a remarkable vessel or rather portion of a vessel—from the south end of the Queen's Island. This was the new fore end of the White Star liner *Suevic*, which went on the Stag Rock last March. The new portion extends to the after bulkhead of No. 3 hold. After being fitted complete with deck-houses, navigating bridge and foremast, this "part of a ship" left Belfast on the 10th, in charge of the Liverpool tugs *Pathfinder* and *Blazer*, *en route* for Southampton, where, as is generally known, the after-portion of the *Suevic* lies in graving dock awaiting her new bow. It

was blowing half a gale at the time of departure, in consequence of which the flotilla came to anchor off Carrickfergus, where it remained until an early hour the following morning, when the voyage was resumed. It is expected that, given favourable weather conditions, the Hampshire port will be reached in three days. On the same day on which the *Suevic's* fore end was taken down the Lough, the Anglo-American Oil Company's steamer *Iroquois*, built and engined by the Queen's Island firm, proceeded on her trial trip. This vessel, which has a carrying capacity for 10,000 tons of oil in bulk, is the first tanker to be fitted with twin screws. These are driven by two sets of quadruple-expansion engines, and the four boilers are arranged for burning oil-fuel. On October 10th, Messrs. Harland & Wolff launched another somewhat remarkable vessel, namely, the ocean-going barge *Navahoe*, also built to the order of the Anglo-American Oil Company. This vessel is practically a sister-ship of the *Iroquois*, minus propelling machinery. She has been designed and constructed to carry the same amount of oil in bulk, and will be taken in tow by the steamer referred to above, which will thus be capable of transporting 20,000 tons of oil in one voyage. The barge will be fitted with the latest type of pumping machinery, also steam steering gear and deck machinery. Electric light will be fitted throughout, and steam will be supplied to all this machinery by a large single-ended boiler, which, like those of the *Iroquois*, will be arranged for the consumption of oil-fuel.

Messrs. Workman, Clark & Co.—This firm is well occupied with work, both in the yards and at the fitting-out wharves. At the latter they have no less than five steamers being completed for sea. Of these, three are for the Lloyd Brazileiro Company, one for the Tyser line, and one for the Shaw Savill and Albion Company. This last is a twin-screw steamer named *Kia Ora* and was put in the water on the 10th of October. She is 464 feet long, with a gross tonnage of 6,800, and has been specially designed for the owners' New Zealand trade. The propelling machinery consists of two sets of triple-expansion engines, and the boilers are five in number, fitted with Howden's forced draught system. In addition to other important orders recently booked by Messrs. Workman, Clark & Co., this firm is said to have secured the contract for two steamers of 7,000 tons for the Blue Anchor line.

JUNIOR ENGINEERS.

XIV.*

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Smithing *(continued).*

MOST of the smaller forgings, such as pins, levers and the like, are worked out of the bar, round or square, as the case may be, and the first operation after cutting off a suitable length is frequently to expand a part at the end, or at some other place, to form a collar or to bulge out the metal to give sufficient for setting down to a rectangular end, such as on the eccentric rod where it is bolted to the sheave. This is done by upsetting the bar and jumping it up; the bar is heated to a white heat, the one end set into a bolster or block, while the other is given heavy blows with the hammer till the hot and softened portion has been spread out sufficiently to make the form required. The bolster, or jumped-up block, is a heavy piece of iron or steel with a round hole sunk into it, in which the end of the bar can be placed while being struck.

To form the rectangular end before mentioned, the softened part is splayed out and fullered down to the required thickness and then hammered on the four sides to the necessary shape.

In welding or butting two ends of a bar together, a scarf or scarph is formed on each by hammering down to wedge shape, keeping the small end thick enough to prevent it burning in the fire and placing one on top of the other, the two pieces are joined up by a succession of rapid blows from the hammer. In order to make the weld more secure one end is sometimes forked and the other made to fit into it; while in welding on a cylindrical piece to a flat plate the former is splayed out as much as possible, the latter having deep indentations cut into it to facilitate the binding together of the two parts.

When drawing out a bar, reducing its girth and increasing its length, the fullering tool is used to make a series of indentations at right angles to its axis and on all four sides, the hammer then being employed to beat down the upstanding metal and thus force the bar to lengthen.

The methods by which any forging is dealt with may be classified as solid forging by drawing out and building up by welding, in many cases these two being combined. In the manufacture of wrought iron the rolling process induces a fibrous nature in the material, and the greatest strength being along the fibre it is so arranged, where possible, that the stresses will take place along this line, and in welding two portions together homogeneity of structure is aimed at by merging the fibres into one another.

In the case of wrought iron the weld can be made as strong as the original material, and with most of the smaller parts where wrought iron is employed the method is left dependent on the ease in making the forging.

With the more important parts, where the ordinary quality of mild steel is used, welding cannot be safely resorted to, as the material is much more difficult to shut together, and in

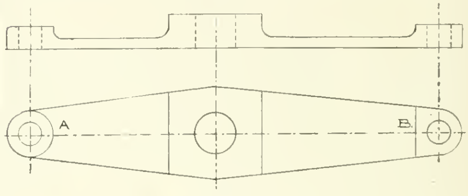


FIG. I.

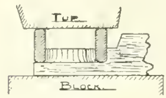


FIG. II.

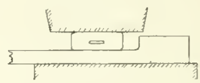


FIG. III.

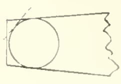


FIG. IV.

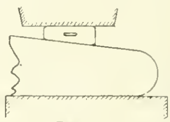


FIG. V.

machined work the scarfs are cut away to a large extent, so that the drawing-out process is invariably adopted.

In making a solid forging the amount of material required is calculated roughly, allowing a small percentage for waste and about an eighth of an inch all over for machining.

Fig. I. shows the ordinary form of solid forged steel pump lever. The three bosses into which the gudgeon pins are shrunk are left solid by the smith and bored out. The ends marked A and B are here shown in different forms, the round boss A was formerly made, but the B type is considerably better, no turning is required and the sides can be planed right out without previous slotting to clear the bosses, also the forging itself is much easier to make.

Fig. II. illustrates the forming of the boss A. This is the method employed for other work where journals or circular bosses are required.

A piece of mild steel of the requisite length to allow for the drawing out, and of a breadth and depth equal to the large boss, is heated at one end and set down to the depth of the boss A. A round tool, the ferrule, with or without a handle attached, is placed on the work and forced in under the steam hammer, thus forming the boss to the required diameter and leaving the sole piece the necessary thickness, allowing for machining in both cases.

The ferrule is knocked off, the top and sides of the billet cogged out and drawn down to shape with set hammers

* For Articles I. to XIII., see last thirteen issues.

or pallets, as at Figs. III. and V. The other two bosses are formed in this manner with pallets, and the end at B rounded up by hammering the sides.

The number of heats required will vary with the size of the work, about one for each end and two in drawing out from the middle boss, starting at one end and finishing at the other, some care being needed to ensure that the centres are the proper distance apart. The corners at A will be cut off, as at Fig. IV., with a hot sate and the ragged edges rounded off.

Levers such as this were formerly made of wrought iron, when the bosses could be welded on to the long plate, but with the adoption of steel the part can be made lighter, and by annealing after the forging is finished a much more uniform and stronger lever is produced.

REVIEWS.

Search-lights: their Theory, Construction and Application. By F. Werz. London: Archibald Constable & Co. 1907.

THIS work will naturally appeal to naval and mercantile marine officers charged with the care of such apparatus, and embodies the author's experience, extending over a course of years. He treats the subject scientifically, and we find the angle of the rays given off closely explained and graphically given. The theory of the parabola naturally comes in for close attention, with the performances of searchlights and the methods of testing. We see the applications on land for coast defence and on battleships, and in this latter case the information is full and complete. We find full details of construction with complete sections showing the actuating carbons. It would be impossible for the particulars to be more fully given. Next, that we find the method of signalling by searchlight and description of the double dispenser for battleship use so important in this connection. Then follows the system adopted for searchlights in the mercantile marine, which is somewhat different. The question of power supply is dealt with in its various forms also, and the treatise generally is thoroughly practical and certain to be of service.

The Modern Machine Shop: its Tools, Practice and Design. Vols. 1 and 2. By Rankin Kennedy. London: Caxton Publishing Co. 1907.

MANUFACTURERS have been drawn upon everywhere for information for this work. The introductory remarks show the author to be a practical man, well versed in requirements. We see first the method of treating the raw materials in the furnace and the general processes of metallurgy. We are led up to the use of electricity in this connection. Now we have foundry cupolas and blowers with moulding machines in every variety, followed by core-making machines and the method of loam moulding. After iron and steel, copper and its alloys are discussed. Electricity has a chapter to itself in its various applications to the machine shop, and amongst these we notice welding. With the tools themselves, we find first the steam hammers, then the pneumatic belt-driven type, followed by the portable hand hammer, so common to-day. Levers and screw presses are practically shown, also forging machinery. Shearing, punching and sawing come next, and in this connection we are led to hydraulic machines, rams, accumulators and riveters. Emery wheel grinding precedes a description of the smithy, which is quite up-to-date, and here we meet with electric welding again. Heating by the same method is shown, as, for instance, in gun winding, pipe work, bending, screwing and tapping are dealt with also sheet metal operating in its various forms, with the tools used. More heavy work is discussed in the second volume, such as plate edge planers, riveting and the accurate gauges used in the machine shop for lathe and like work. Drilling and boring from its importance has a chapter to itself, and the lathe with its change wheels for screw cutting follow and a description of the heavy cut tools in use to-day. Taking the books on a whole, they are a good epitome of present practice in machine tools. There is no accurate division between the two volumes. We have plenty of illustrations and the descriptions are good, but rapidly drawn. This does not detract however, from their value.

PARAGRAPHS.

Coaling at Sea.—We have a pamphlet before us issued by the Lidgerwood Manufacturing Co., of New York, relating to their system of coaling in a seaway, and we see a vessel being so coaled at the rate of 3000 lb loads every 50 seconds. The system is described as adopted in the United States, British, Russian and Italian navies. The arrangement and description is clear and easy to follow, the illustrations being so good. The apparatus for working is fitted on the battleship and the collier towed. This is one of the principal features, sea-anchors being used to give tension to the conveying rope. The class of winch used for operating the carriage on the cableway is described also, and other systems, such as the Temperly, are found, but the general arrangement is similar in the two cases.

Messrs. Plutte Scheele & Co., of Queenhithe, London, E.C., send us a catalogue of their portable electric saws for cutting up boards to 3 inches thick. These machines are capable of being wheeled about, the electric motor and starter being built into the machine. While in some cases logs have to be lifted 12 inches on to the machine, in others the machine is shown tilted and cutting the tree as it lies on the ground. A further machine is for felling trees and cutting up logs while floating.

Thorn's School of Marine Engineering.—At the examination for Extra First-class Engineers, held on October 9th, 10th and 11th, the following candidates were successful: Mr. D. J. Rees, South Wales; Mr. A. G. Sterling, Gourock; Mr. J. Willis, Leith; and Mr. J. B. Hall, Jarrow. Three of these were prepared by Mr. Thorn's original system of tuition by correspondence, two passing the first time of going up. They were prepared by W. H. Thorn & Son, 5, Waterville Terrace, North Shields, from whose establishment 150 extras, 29 surveyors', and over 6800 ordinary certificates have been obtained. During the last five years, out of 73 successful pupils for extra first, 36 have been prepared by correspondence, and of these 28 have passed the first time of going up, a thorough proof of this firm's method of postal tuition.

A Large Oil-Tank Steamer.—The *Iroquois*, a steamer built by Messrs. Harland & Wolff, Ltd., for the Anglo-American Oil Company, and specially designed and constructed for the carriage of about 10,000 tons of oil in bulk, left the harbour on October 19th on her trial trip, and subsequently proceeded to Barry to coal prior to taking up her station. The new vessel is the first oil-tank steamer to be fitted with twin screws; she will carry more oil than any other ship afloat, and she is the largest steamer yet built for this company, which is controlled by Mr. Rockefeller, the head of the Standard Oil Company, in America. The gross tonnage of the ship is over 9,200 tons; the length, 476 ft.; the breadth 60 ft.; the depth, 35 ft. 5½ ins.; and she has been constructed of steel throughout to Lloyd's special survey. The oil will be contained in eighteen compartments, and an exceptionally complete oil-pumping system for loading and discharging has been provided, together with all the necessary appliances—steam windlass, winches, warping and steering gear, etc., for use in a vessel of this class. The machinery, which has also been constructed by Messrs. Harland & Wolff, and specially arranged for the consumption of oil-fuel, consists of two sets of quadruple-expansion engines, with four steel boilers. The captain is accommodated in a large house on the bridge-deck, the officers under the bridge, and the engineers under the poop all the rooms being specially large, and the ventilation of these, as well as all the other spaces for living in, being of a special character. There is a large dining saloon under the bridge, and the firemen and seamen are berthed at the front of the poop. Electric light has been installed throughout, with two direct-coupled dynamos to turbines, and refrigerating machinery is provided. Captain J. D. Scott is in command of the *Iroquois*, which left the Lough in the afternoon, having on board Mr. Ford of the Anglo American Oil Company, New York; Mr. MacLean, manager of the company's shipping department London; and Mr. Morton, who has superintended the building of the ship. The same builders have also in hand for the Anglo-American Oil Company an enormous barge, which will carry about a similar quantity of oil to the *Iroquois*, and which, it is expected, will very shortly be ready to leave.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Voreda.—On September 23rd, a new steel screw steamer was launched from the yard of Messrs. R. Williamson and Son, Workington. The principal dimensions are: Length, 163 ft. 9 in.; breadth, 26 ft. 6 in.; depth moulded, 13 ft. 2 in., and is designed to carry 750 deadweight on Lloyd's freeboard. The vessel is built to the highest class at Lloyd's, and will be propelled by engines of the triple-expansion type having cylinders 14 in., 22 in. 37 in., with a stroke of 27 in., steam being supplied by a large cylindrical steel boiler 13 ft. 6 in. dia. by 10 ft. long, working at a pressure of 160 lbs. The vessel has been built by the above builders and is named *Voreda* of Workington, and if unsold on completion it is their intention to run her in the coasting trade.

Clan Buchanan.—On September 24th, Messrs. W. Doxford and Sons, Ltd., launched a large turret vessel built to the order of the Clan Line Steamers, Ltd. (Cayzer, Irvine and Co.), Glasgow. The vessel, which is a duplicate of the *Clan Graham* and *Clan Sinclair*, was named the *Clan Buchanan* by Mrs. Charles Cayzer, of London and Brighton. The *Buchanan* carries 8200 tons and steams 11 knots, and is fitted with 'tween decks of the latest type of construction for the special carriage of railway rolling stock. The vessel is fitted with tri-compound engines, also built by Messrs. Doxford. Messrs. S. T. Taylor & Sons have covered boilers, pipes, etc., with their "Tynos" non-conducting material.

Dewsland.—On September 24th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 120 ft. 0 in. by 21 ft. 9 in. by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Wm. Jenkins, Esq., of Milford Haven, and will be fitted with powerful triple-expansion engines by Messrs. Amos and Smith, of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Dewsland* by Miss Isabel C. Smart, of Cardiff, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Gloria.—On September 24th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 120 ft. by 22 ft. by 12 ft. 3 in. depth of hold. The vessel has been built to the order of Messrs. James & Longthorp, of Milford Haven, and will be fitted with powerful triple-expansion engines by Messrs. Amos and Smith, of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Gloria* by Mrs. A. Peaker, of Leeds, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Newport News.—On September 24th, Messrs. Irvine's Shipbuilding and Dry Dock Co., Ltd., West Hartlepool, launched the handsome steel screw steamer *Newport News*, built for the Furness Line. She is of the following dimensions:—336 ft. by 47 ft. by 24 ft. 10 in., having single deck, poop, bridge and topgallant forecastle, and has been built to the British Corporation Registry's highest class. A double bottom is fitted throughout on the cellular principle, and the fore and after-peak tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stringers, giving clear holds for the storage of bulky cargoes. Fine water tight bulkheads divide the holds into six water tight compartments, and wood grain divisions are fitted in the holds. She also has extra large cargo hatches, five steam winches which are supplied with steam from a vertical multitubular donkey boiler, and is replete with all the latest improvements for rapid loading and discharging. A powerful quick-warping steam windlass is fitted forward for the working of the cables and steam steering gear is fitted amidships with hand screw gear aft. Accommodation for captain and officers is arranged in poop, engineers in houses amidships, crew and firemen in forecastle. The sanitary, ventilating and lighting arrangements have received special attention and have been effected on the most approved lines. Triple-expansion engines are being supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 24 in., 38 in., 64 in. by 42 in., two large S.E. boilers 160 lbs. pressure. The vessel was named *Newport News*.

Dunelm.—On September 25th, there was launched from the yard of the Sunderland Shipbuilding Company, Ltd., a steel screw steamer 250 ft. length between perpendiculars, by 43 ft. 1 in. broad by 26 ft. 6 in. deep, having deck-houses aft over machinery, short bridge forward, and topgallant forecastle, two-deck type, highest class in British Corporation. Accommodation for captain is placed in bridge-house forward, and for officers and engineers aft, whilst the sailors and firemen are berthed in the forecastle as usual. The saloon is in a deck-house at the after-end and is fitted up in polished hardwoods. The deck machinery consists of steam winches, steam steering gear, and direct steam capstan windlass, the cargo being worked by special machinery placed under the deck. The main engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 19½ in., 33 in. and 54 in. by 36 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of Messrs. Dunelm, Limited, the managers being Messrs. R. O. and A. B. Mackay, Hamilton, Canada, and during construction has been inspected by Mr. Middleton, of Newcastle, on behalf of the owners. On leaving the ways the vessel was gracefully named *Dunelm* by Mrs. Macintyre, of Consett.

Blackwell.—On October 5th this vessel was launched from the North Sands Shipbuilding Yard of Messrs. Joseph L. Thompson & Sons, Ltd., and has been specially constructed to the order of Messrs. The Tyzack & Branfoot Steam Shipping Co., Ltd., of Sunderland, and is the thirteenth vessel Messrs. Thompson have constructed for these owners. She is specially designed for their "Well Line," trading between Middlesbrough and London and Calcutta. The principal dimensions of the vessel are:—Length, overall, 417 ft.; breadth, extreme, 50 ft. 9 in.; depth, moulded, 29 ft. 9 in. She has been constructed under Lloyd's special survey for their highest class on the spar deck rules, and deep frame system, and has a poop 27 ft. long, bridge 112 ft. long, and forecastle 43 ft. long. The officers', engineers' and passengers' accommodation is on the bridge, the saloon being tastefully fitted up in polished hardwoods, and the whole of this accommodation is heated by steam radiators. There is a most elaborate arrangement of deck machinery and derricks for the rapid handling of cargoes, and provision is made for dealing with lifts up to 25 tons weight. A complete electric-lighting installation will be fitted by Messrs. The Sunderland Forge and Engineering Co., Ltd., of Pallion, Sunderland, including clusters for working cargoes at night time and a projector for use in the Suez Canal. The vessel has been designed on very fine lines and presents a most graceful appearance afloat; when completed she will be a splendid example of a modern up-to-date cargo vessel and should do well in her journeys to and from India, for which route she is intended by the owners. Powerful engines and boilers are being constructed by Messrs. The North-Eastern Engineering Co., Ltd., of Sunderland, the sizes of the cylinders being 27½ in., 45 in., 76 in. by 48 in. stroke, supplied with steam by three large boilers working at 180 lbs. pressure. Messrs. Wailes, Dove & Co.'s bitumastic covering was applied to the tank top in boiler-room. There was a large company present at the launch, which was most successful in every way, the vessel being gracefully christened by Miss Stobart, of Biddick Hall, daughter of Frank Stobart, Esq., High Sheriff for the county. After the launch the company adjourned to the builders' luncheon-room, where the usual toasts were duly honoured, there being present Mr. and Mrs. J. W. Branfoot, Mr. and Mrs. Scott Gunn, Mr. Frank Stobart, Miss Stobart, Miss Pattinson, Mrs. C. L. Wilson, Mr. and Mrs. Chas. Bevan, Dr. Maling, Mr. Geo. Maling, Mr. and Mrs. Arthur Johnson, Captain Brown, Mr. S. N. Hopkins, Miss Armstrong and the members of the builders' firm. Mr. Jas. Marr, in proposing success to the *Blackwell*, remarked that his firm made their first contract with Messrs. Tyzack & Branfoot twenty-three years ago. The vessel then contracted for, named *Edmondsley*, carried 1950 tons, whereas the vessel just launched would carry over 7500 tons, showing the remarkable advance in shipbuilding during that period. The two models which

were lying side by side conveyed better than any description he could give the great difference between the size and style of the two periods. The *Edmondsley* took five months to build, and steamed eight knots, and the *Blackwell* will steam thirteen knots when required, and was ready for launching in sixty-nine working days from the laying of the keel. He believed that to be a record, and a further illustration of the extraordinary progress made in shipyard equipment during the last twenty years. Mr. Scott Gunn replied on behalf of the owners, and concluded by proposing the health of Miss Stobart, who had so successfully performed the christening ceremony, to which Miss Stobart replied in a graceful little speech. The health of the builders having been duly honoured the company separated.

Crispin.—On October 7th, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw passenger and cargo steamer built to the order of Messrs. The Booth Steamship Co., Ltd., Liverpool. She is being built to class 100 A1 at Lloyd's, shelter deck type and to comply with the U.S.A. requirements for passenger certificate, her leading dimensions being 366 ft. 3½ in. by 49 ft. 2½ in. by 26 ft. 6 in. moulded with a deadweight carrying capacity of about 5900 tons on a light draught. The upper main and shelter decks are of steel. A large steel deck-house on shelter deck amidships forward of engine and boiler casing will be fitted up for saloon, captain's room and state rooms, with chart-room above, and wheel-house on top of latter. Officers' and engineers' accommodation will be provided in houses alongside engine and boiler casing, and the crew will be berthed aft in vessel. Water ballast will be carried in cellular double bottom, fore and aft peaks and in a deep tank amidship, and she has four holds, five hatchways, eight water-tight bulkheads, four boats, hand and steam steering gear, two masts, two derrick posts, and 13 derricks, including a very special steel derrick to lift 40 tons; these will be actuated by nine powerful steam winches, and all the latest and most modern appliances for the efficient working of cargo. Triple-expansion engines will be fitted by the North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, having cylinders 25 in., 41 in. and 65 in. by 48 in. stroke, supplied with steam by three large single-ended boilers fitted with Howden's forced draught and working at 180 lbs. pressure. On leaving the ways she was gracefully christened *Crispin* by Mrs. Isaacs, wife of the owner's naval architect. The hull and machinery are being constructed under the supervision of Mr. W. Isaacs and Mr. W. Berkett, the owners' superintendent engineer.

Vikingen.—On October 7th, Messrs. S. P. Austin & Son, Ltd., launched from their shipbuilding and repairing establishment at the Wear Dockyard, Sunderland, the steel screw steamer *Vikingen*, which has been built to the order of Messrs. The Fornyade Angfartygs Aktiebolaget Viking, of Gothenburg. She is designed to carry about 4000 tons deadweight on 19 ft. 9 in. draught, and will be classed 100 A1 in Lloyd's register under special survey. Accommodation for the captain is provided in a house on the fore-end of bridge deck, engineers and officers in house on after-end of bridge and crew in forecastle. The machinery will be supplied by the North-Eastern Marine Engineering Co., Ltd., the deck machinery, including steam windlass and nine steam winches, by Messrs. Clarke, Chapman & Co., Ltd., and steam steering gear by Messrs. Donkin & Co. Messrs. Wailes, Dove & Co.'s bitumastic cement was applied to flat of bottom all fore and aft, bitumastic covering to tank top under boilers and their bitumastic enamel to the structures in double bottom fore and aft and in bunkers. The construction has been carried out under the superintendence of Mr. H. J. H. Wilson, of Messrs. A. G. Schaefer & Co., Newcastle-on-Tyne, on behalf of the owners, and the vessel was gracefully named by Miss Dalman daughter of the chairman of the owners' company.

Harport.—On October 8th, there was launched from the shipbuilding yard of Messrs. John Readhead & Sons West Docks, South Shields, a new screw steamer built to the order of Messrs. J. & C. Harrison Ltd. London The vessel is of the following dimensions 383 ft. overall by 50 ft. by 27 ft. depth moulded. She has been built to Lloyd's highest class, and is of the improved single-deck type having large holds quite clear of all beams and side pillars, with an extra long and lofty bridge and poop There are deck-houses on the bridge for captain and officers, the accommodation for engineers being in a steel house alongside of engine casing, crew being berthed in top gallant forecastle. She is also fitted with double bottom all fore and aft for water ballast, also with large tank in after-peak for the same purpose. The arrangements for loading and discharging are of a complete and up-to-date character, the vessel being fitted with eight large steam winches supplied with steam from a donkey boiler of multitubular type ; also ten derricks which are worked from outriggers and tables on the masts. The vessel will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, having cylinders 26 in., 42 in. and 70 in. by 45 in. stroke, supplied with steam from two large steel boilers working at a pressure of 180 lbs. per square inch. The steamer has been superintended during construction by Mr. E. J. Caiger, of London, on behalf of the owners. As the vessel left the ways she was named the *Harport* by Mrs. James Readhead, jun.

Lady Carrington.—On October 8th, from Messrs. Doxford's yard at Pallion, there was launched the turret steamer *Lady Carrington*, built to the order of Messrs. Williams and Mordey, Cardiff. The length of the vessel is 350 ft., the breadth 49 ft., and the moulded depth 26½ ft. The weight of cargo and bunkers carried is 6700 tons. Engines are supplied by Messrs. Doxford to give a speed of 10 knots. The construction has been superintended by Mr. David on behalf of the owners, and by British Corporation surveyors. In the presence of several visitors from Cardiff the christening ceremony was pleasingly performed by Mrs. Mordey, of Cardiff.

Selja.—On October 8th, Messrs. William Gray & Co., Ltd., launched at West Hartlepool the handsome steel screw steamer *Selja*, which they have built to the order of Wilhelm Jebsen, Esq., Bergen. She will take the highest class in Lloyd's Register and is of the following dimensions, *viz.* :—Length overall, 391 ft. 6 in. ; breadth, 49 ft., and depth, 29 ft., with long bridge, poop and topgallant forecastle. The saloon, state-rooms, captain's, officers', engineers' rooms, etc., will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep bulb-angle frames, cellular double bottom and large aft-peak ballast tank. The vessel has eight steam winches steam steering gear amidships, and screw gear aft, patent direct steam windlass, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig boats on deck overhead and a very complete outfit for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 41 in. and 68 in. dia. with a piston stroke of 48 in., and three large steel boilers for a working pressure of 180 lbs. per square inch. The ship and machinery have been built under the superintendence of Mr. Fred. Th. Hansen, of Bergen, on behalf of the owners.

Marham Abbey.—On October 9th, Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.* :—Length, 395 ft. ; breadth 50 ft. ; depth, 25 ft. The vessel is built to the highest class at British Corporation to the order of Messrs. Williams and Mordey, of Cardiff, and is fitted with the builders' patent improved trunk deck, with clear holds and deep frames. The saloon-house, with accommodation for captain and officers and a house for engineers, will be fitted up on trunk deck, with the crew in topgallant forecastle and apprentices aft. The vessel has double bottom for water ballast on the cellular principle, also in the fore and after-peaks. The deadweight carrying capacity will be about 7250 tons on her summer freeboard. The vessel will be fully equipped with an up-to-date outfit, having a quick warping windlass, stockless anchors, steam steering gear amidships, with powerful screw gear aft. The appliances for loading and discharging expeditiously are very complete, and include extra derrick posts and double derricks, eight steam winches, steam being supplied by a horizontal multitubular donkey boiler. The engines will be of the triple-expansion type supplied by Messrs. Blair & Co. Ltd., Stockton on Tees of about 1750 I.H.P. steam being supplied by two large main boilers at a working pressure of 180 lbs. per square inch. The hull and engines have been built under the superintendence of Mr. John David, Porthcawl South Wales. The christening ceremony was gracefully performed by Miss Williams, of Cardiff, who gave the vessel the name of *Marham Abbey*.

Royal Prince.—On October 9th, Messrs. Short Brothers, Ltd., launched from their shipbuilding establishment at Pallion, Sunderland, the handsomely modelled screw steamer *Royal Prince*, built to the order of the Prince Line, Ltd., Newcastle-on-Tyne. Her dimensions are:—Length, 432 ft.; beam, 54 ft. 4 in.; and depth moulded, 30 ft. 10 in., and she will carry a deadweight cargo of 9200 tons. The vessel is of the shelter-deck type with upper and main decks laid, and is fitted throughout in accordance with the requirements of the Board of Trade and Lloyd's Register for a passenger steamer. The cellular double bottom, except under boilers, and the fore and after-peaks are fitted for the carriage of water ballast, in addition to a large chamber tank, holding about 1000 tons, and arranged for carrying either water or cargo. The loading and discharging arrangements have received the close attention of owners and builders; derrick tables and cross-trees are fitted on each mast, twenty-two derricks suitable for ordinary lifts, a large steel derrick for lifts of 30 tons, with fittings to work from either mast, and the masts specially strengthened and supported to withstand the strains. The decks are supported by strong girders and wide-spaced pillars, so that the holds may be suitable for the stowage of large pieces of machinery or other bulky cargoes. Eight water-tight bulkheads subdivide the vessel, and six large hatchways are fitted through all decks. The 'tween decks are suitable for the carriage of horses and troops, three large port doors being fitted on each side of shelter deck, and both 'tween decks being pierced by sidelights. Accommodation is fitted in a large deck-house on shelter deck for twenty-four first-class passengers, with saloon and smoke-room; the panelling of the saloon has been specially designed in light oak, and the smoke-room in mahogany. The officers' and engineers' accommodation is provided in deck-houses alongside casing on shelter deck, and the crew are berthed in the fore end of shelter deck. Every provision will be made for the comfort of passengers and crew, shower and plunge baths being fitted with hot and cold water supplies, also steam heating throughout. Wilson & Pirrie's patent combined steam and hand-steering gear is fitted in large house at after-end of shelter-deck controlled from wheels on upper and lower flying bridges. Thirteen steam winches, steam and hand windlass and steam ash hoist with shoot overboard, are supplied, driven from a large auxiliary multitubular donkey boiler working at the same pressure as the main boilers. Electric lighting will be installed throughout together with electrically-driven fans to ventilate accommodation and holds; electric bells to passengers' rooms. The propelling machinery is by The North-Eastern Marine Engineering Co., Ltd., of Wallsend, and consists of quadruple engines with cylinders 24½ in., 35 in., 51 in., 74 in. diameter, with a stroke of 51 inches, taking steam at 220 lbs. pressure from three large marine boilers and the donkey boiler. The vessel has been surveyed during construction by Mr. J. Trail and Mr. J. G. Pringle, the owners' superintendents. The christening ceremony was gracefully performed by Miss E. Scott, daughter of the chairman of the Prince Line Co.

Botanic.—On October 10th, there was launched from the yard of Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, a handsomely modelled steel screw trawler, which has been built to the order of the City Steam Fishing Co., Ltd., Hull. As the vessel left the ways she was gracefully christened *Botanic* by Mrs. J. A. Laverack. The dimensions of the vessel are 141 ft. 8 in. by 23 ft. by 13 ft. moulded, and has been built under special survey for 100 A1 class at Lloyd's, with scantlings in excess of their requirements. The vessel has been constructed for the White Sea and Iceland trades, and is fitted up complete with boat davits, turtle deck and stern hood, together with all the latest improvements in fishing gear. The machinery will consist of a set of triple-expansion surface-condensing engines, having cylinders 13 in., by 22 in. by 37 in. by 27 in. stroke, steam being supplied by a large boiler working at a pressure of 200 lbs. per square inch.

Thimbleby.—On October 11th, Messrs. Osbourne, Graham and Co. launched from their yard at Hylton, the steel screw steamer *Thimbleby*, which they have specially built to the order of Messrs. Furness, Withy & Co., Ltd. for the Pomaran ore trade. She is a single-deck steamer designed to carry a large cargo on a moderate draught, and takes highest class at British Corporation. Accommodation is fitted in the poop, and the officers and engineers are situated amidships. Her deck equipment comprises all the latest appliances for quick handling of cargo, large multitubular donkey boiler, steam steering gear, etc. Her machinery will be fitted by Messrs. MacColl & Pollock, of Sunderland, and are capable of driving the vessel 9½ knots loaded at sea. The christening ceremony was gracefully performed by Mrs. Leicester Wilson, of Sunderland.

LAUNCHES—Scotch.

Envira.—On October 1st, there was launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, a steel twin-screw steamer, 150 ft. long, built for passenger and cargo, service on the River Amazon. The vessel is classed in Lloyd's, and the scantlings have been largely increased to suit special requirements. As the vessel left the ways she was named *Envira*, after which she was taken to Glasgow, where two pairs of compound engines will be fitted on board by Messrs. Ross & Duncan.

Steel Screw Steamer.—On October 5th, Messrs. Archd. McMillan & Son, Ltd., Dumbarton, launched a steel screw steamer for service on the Canadian lakes. The vessel is about 260 ft. long and is a duplicate of the steamer launched by the builders last month. The machinery, which is fitted aft, is being supplied by Messrs. Muir & Houston, Ltd., Glasgow.

Kooyong.—On October 8th, there was launched from the Castle Works of the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, for Messrs. McIlwraith, McEacharn and Co. Proprietary Ltd., of Melbourne, a steel cargo steamer, 295 ft. by 44 ft. by 22 ft. 3 in. The vessel was named *Kooyong* by Miss Margaret Thomson, daughter of Mr. H. T. Thomson, of Calcutta, and niece of Mr. R. E. Thomson, the Company's Superintendent Engineer, under whose supervision the vessel and machinery have been constructed. Immediately after the launch, the vessel was placed under the crane in the builders' dock to receive her engines and boilers, which have also been constructed by the builders.

Ardanmhor.—On October 18th, there was launched from the shipbuilding yard of Messrs. David & William Henderson and Co., Ltd., Partick, the large steel screw cargo steamer, *Ardanmhor*, which they have constructed to the order of Messrs. Clark & Service, of Glasgow. This latest addition to the fleet of vessels owned by this firm is in length 400 ft. over-all; breadth, 50 ft.; with a depth of 28 ft. 8 in. moulded, having a gross tonnage of about 4400, and will be classed in British Corporation. She has been fitted with all the latest improvements to ensure the rapid and fast working of the large cargo which she has been designed to carry, including eight powerful winches and also large derricks fitted at the hatches. A complete installation of electric light has been fitted throughout the vessel. Steam steering gear is fitted amidships; the saloon and officers' accommodation is on the fore end of bridge deck and a chart-room and wheel-house have been built above this, with a bridge which will give every facility to the officers in the navigation of the vessel. A set of triple-expansion engines will be supplied and fitted by the builders, having cylinders 25 in. 41 in., and 67 in. diameter by 4 ft. stroke, also three large single-ended boilers, working at a pressure of 180 lbs. The vessel was launched without any ceremony.

Copenhagen.—On October 22nd, Messrs. John Brown & Co., Ltd., launched from their yard at Clydebank, a new vessel which they are building for the Great Eastern Company's service between Harwich and the Hook of Holland. The steamer, which is almost solely designed for the transport of passengers, mails and baggage, will have a speed of 20 knots. The principal dimensions are:—length (overall), 343 ft.; breadth (moulded), 43 ft.; depth (shelter deck), 26 ft. 6 ins.; and of about 2600 tons gross. Mild steel has been used in her construction, and special attention has been given to the strength of scantlings, which are much above the average for vessels of her size. She has been constructed to the requirements of the Board of Trade for passenger certificate. Accommodation is provided amidships on the lower, main and awning decks for 320 first-class, and aft on lower and main decks for 130 second-class passengers. The first-class dining saloon is a large and handsome apartment on the lower deck, and occupies the full breadth of the vessel, with seats for

sixty-two persons, and on the main deck immediately above is a well-appointed ladies' room. A large smoking-room is situated on the awning deck. The spacious promenade is under shelter of the long boat-deck, part of which is also intended for the use of first-class passengers, the fore part being railed off for the navigating staff. The propelling machinery, which has also been constructed by the builders, consists of a set of steam turbines of the Parsons type, comprising one high-pressure and two low-pressure, with two astern turbines, fitted within the low-pressure turbines casings. Steam is supplied by five large single-ended boilers working on the closed stokehold system of forced draught. The vessel is fitted complete with all modern deck machinery, such as windlasses, capstans, winches, etc. Wailes, Dove & Co.'s bitumastic enamel was applied to the peaks, ballast tanks, chain lockers and bunkers, also open bottom in boiler space and the bitumastic cement to the flat of bottom. A complete equipment of electric lighting has been installed, and the ventilating and sanitary arrangements are excellently planned, being up-to-date in all respects. The vessel will be rigged as a two-masted fore and aft schooner, and has been built on very fine lines in view of attaining high speed. After launching, the vessel was berthed in the builders' basin to receive her machinery and complete fitting out. Miss Ida Hamilton, daughter of the chairman of the Great Eastern Railway Company, named the vessel *Copenhagen*.

Saint Mungo.—On October 22nd, there was launched at Bowling by Messrs. Scott & Sons, a cargo steamer which they have built to the order of Mr. Robert Harper, Glasgow. The dimensions are 155 ft. by 23 ft. by 12 ft. (moulded). After the launch the vessel proceeded to Glasgow for her machinery, which will be fitted on board by Messrs. Ross & Duncan Govan. On leaving the ways the vessel was named *Saint Mungo* by Mrs. Harper, Pollokshields, Glasgow.

Trawler.—On October 22nd, there was launched at Aberdeen by Messrs. Hall, Russell & Co., Ltd., Footdee, a steam trawler built to the order of the North Steam Fishing Co., Ltd., Aberdeen. The length of the vessel is 115 ft., breadth 21 ft. 6 in., and depth 12 ft. 6 in. Steel boiler and triple-expansion engines will be supplied and fitted by the builders.

LAUNCHES—Irish.

Asturias.—On September 26th, the twin-screw mail steamer *Asturias* was launched from the yard of Messrs. Harland and Wolff, Ltd., Belfast, for the Royal Mail Steam Packet Co. The launch of this steamer emphasises the progressive policy of the Royal Mail Steam Packet Co., one of the oldest, and now recognised as one of the most efficient for British steamship lines. In addition to being one of the finest vessels in the R.M.S.P. fleet, the *Asturias* will be one of the largest steamers engaged in the Australian trade. Her dimensions are: Length 535 ft., beam 62 ft. 4 ins., with a gross register of about 12,500 tons. The *Asturias* is designed to carry a large quantity of cargo, but passenger accommodation on the most sumptuous scale is her speciality. A point deserving particular mention is that the state-rooms are on deck, an improvement that will appeal strongly to intending voyagers. There are some very handsome two-bedded state rooms (no upper berths), beautifully decorated and with bath-rooms attached to them. Many of the state-rooms are arranged on the tandem principle, with side-lights for each room. Single berth state-rooms are a special feature, so that travellers can rely on the same privacy and comfort on this "Floating Hotel" as in hotels ashore, the entire accommodation in the lower promenade deck-house being arranged in this manner. There are a number of Suites de Luxe (now so well known on the R.M.S.P. steamers), and these are to be magnificently furnished in white and gold with silk panellings. An electric passenger elevator is provided, serving four decks and landing passengers either in the saloon or the social hall and lounge. The first-class dining saloon bids fair to surpass the most handsome afloat. The tables—seating 300 passengers—are arranged on the latest restaurant system. The elegance of the whole structure, combined with the magnificent stairway and approach to the main deck, forms a rare example of marine architectural beauty. The style is Renaissance—in oak, white and gold furnishing adorned with cupids and sea trophies. The dome, modelled after that of the Genoese Palace, is most ornate and brilliantly lighted; and the saloon is specially ventilated by a very complete arrangement of electric fans. The decorations of the social hall and lounge, situate on the promenade deck, are in Austrian oak, the structure being surmounted by two handsome domes of stained glass. The smoke-rooms (upper and lower) are on the upper promenade and boat decks aft, and are exceptionally well ventilated; they are decorated with Dutch tiles giving views of the different places of interest in the ports and countries to which the Company's vessels trade, the woodwork being carried out in oak panelling handsomely carved. The arrangement of the rooms is very attractive and comfortable, with a staircase leading from one to the other, and the popular "well" formation giving a balcony to the upper room. The rooms are also mechanically ventilated with thirteen electric fans. A nursery adjoins the first saloon on the main deck. Electric fans will be fitted in every cabin in the first and second-class accommodation. The second-class accommodation is a special feature in this vessel. The second-class saloon, smoking-room and social hall are most tastefully decorated in the very latest style; the smoking-room is surmounted with a handsome glass dome with mechanical ventilation, everything in fact being done to ensure the comfort of the passengers. There are ample promenade spaces allotted to the second-class passengers. The third-class accommodation provides for a large number of passengers, whose comfort in sleeping rooms, dining rooms, lavatories and deck space is well catered for. For the convenience of passengers a laundry, worked by electricity and supplied with all modern electric appliances, will be fitted on the after-deck. Every provision has been made for the safe navigation of the steamer, and by the adoption of Messrs. Harland & Wolff's latest "balanced" quadruple type of engines vibration is reduced to a minimum. The double set of engines for the twin-screws constitutes, of course, an additional element of safety. The *Asturias* is a schooner-rigged vessel with two masts, and her graceful lines and fine appearance excite admiration. She is an eloquent tribute to the high hopes entertained by the Royal Mail Steam Packet Company of the future of the Australian trade, and cannot fail to meet with unqualified approval of the travelling public and merchants, for whose comfort she has been built. The *Asturias* is expected to make her first voyage in the Australian Mail Service early next year.

Kia Ora.—On October 10th, Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their North yard, the large twin-screw steamer, *Kia Ora*, which they have built and engined for the Shaw Savill and Albion Co., Ltd., of London. The new steamer has been specially designed to meet the requirements of the owners' New Zealand trade, and is about 464 ft. long, with a gross tonnage of 6800 and a deadweight capacity of about 10,000. The *Kia Ora* has been built under Lloyd's special survey for the highest class in their registry, besides conforming to all the requirements for a Board of Trade passenger certificate. The vessel is constructed on the fore and aft girder principle, which leaves the five holds, into which the cargo space is divided, free of obstruction and capable of receiving the most bulky class of consignments, such as locomotives, boilers, motors, etc. Three of the holds have been specially insulated and prepared for the reception of cargoes of frozen mutton, and for the preservation of these cargoes during transit an efficient system of refrigerating machinery has been installed. Each of the holds is provided with a large cargo hatch suitably equipped with the necessary steam winches and derricks, capable of speedily loading and discharging cargo. A large steel deck-house has been erected on the shelter deck amidships, in which a handsome saloon has been fitted, as well as comfortable accommodation for a number of first-class passengers, the captain, officers and engineers, berths for the petty officers and crew having been arranged on the upper deck forward. The propelling machinery consists of two sets of triple-expansion engines having all the latest improvements, steam being supplied from five steel single-ended multitubular boilers, working under Howden's system of forced draught. Messrs. S. T. Taylor & Sons have covered boiler bottoms with their "Tynos," patent removable asbestos mattresses. The construction of the vessel and machinery has been carried out under the supervision of Captain McKirdy, R.N.R., and Mr. Geo. Adams, the superintendent for the owners.

Navahoe.—On October 10th, Messrs. Harland & Wolff successfully launched the ocean-going barge *Navahoe*, built to the order of the Anglo American Oil Co. This vessel is

450 ft. long by 58 ft. beam, and about 8000 tons register, and has been specially designed and constructed for the transport of over 10,000 tons of oil in bulk. The vessel will have an exceptionally complete oil pumping system for loading and discharging, also steam steering gear, deck machinery, etc., all the arrangements being of the latest type. There will be a large single-ended boiler (arranged for burning oil fuel) to generate the power for driving the pumps, etc. A very complete installation of electric light is fitted. The vessel is fitted with six masts, with fore and aft sails and gear complete, also a special towing machine and large patent towing chock for connecting her with one of the Company's steamers, by which the barge will be towed across the ocean, the *Navahoe* being the counterpart of the *Iroquois*, now finishing for the same company, the combination of the two vessels enabling one steamer to bring from port to port 20,000 tons of oil at one time. Messrs. Wailes, Dove & Co.'s bitumastic enamel was applied to the peaks, copper dams, ballast tank and boiler space, and the bitumastic covering to the flat of deck in boiler space. The owners were represented by Mr. MacLean, general manager, Mr. Ford, of New York, naval architect, and Mr. Hallenbach, assistant manager of the Shipping Department, New York.

TRIAL TRIPS.

Queen Elizabeth.—On September 18th, the fine steel screw steamer *Queen Elizabeth*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. The Merito Shipping Co., Ltd., Glasgow (Messrs. Thomas Dunlop & Sons, managers), left the Tyne for her trial trip. The vessel, which is the sixth steamer of the same type ordered by the same managers, is 372 ft. overall by 48 ft. beam extreme by 30 ft. 10 in. D.M., and has been built under special survey to the highest class at Lloyd's, spar deck rule with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation which is very ample being all placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops, or emigrants may be carried, if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes has been arranged for, consisting of eight steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, steam steering gear by Messrs. John Hastie & Co., Greenock, and steam windlass by Messrs. Emerson, Walker & Thompson Bros. She is, of course, fitted with the usual water ballast arrangement for light passages. The steamer will carry about 7300 tons deadweight. The machinery has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, the engines having cylinders 25 in., 41 in. and 69 in. by 48 in. stroke; three large steel boilers 14 ft. by 10 ft. 9 in., 180 lbs. working pressure. The trial trip proved in every way satisfactory, and a speed of 11¾ knots was easily obtained. Among the guests on board were the following:—Messrs. Robert and Thomas Dunlop, Thos. Dunlop, jun., John Greenlees, and J. M. Broom, representing the owners; Mr. Rowland Hodge and Mr. J. Graham representing the shipbuilders; Mr. A. Harrison, representing the engine builders. After the trial trip the steamer proceeded to Newport News to load, under the command of Captain Ritson.

Washington.—On September 18th, the new steel screw steamer *Washington* (of which we gave particulars in our October issue, page 114), built by Irvine's Shipbuilding and Dry Dock Co., Ltd., West Hartlepool, for the Furness Line, proceeded to sea on her trial. After a series of runs a mean speed of .0½ knots was attained, the ship and engines giving every satisfaction. Mr. Tose was present representing the owners, Mr. Urquhart the engine builders, and Mr. A. S. Purdon the shipbuilders. The vessel is supplied with a Cochran (Annan) donkey boiler with patent seamless furnace.

Maylands.—On September 21st, the trial trip took place of the handsome steel screw steamer *Maylands* (of which we gave particulars in our October issue, page 114), which has just been added to the fleet of steamers owned by The Wilson Shipping Co., Ltd., West Hartlepool (Messrs. Joseph H. Wilson & Co., managers). The trial was carried out satisfactorily, the mean speed of ship being 11¼ knots, and the performance of ship and machinery all that could be desired. The vessel afterwards proceeded on her voyage to Hamburg.

Zeeland.—On September 21st, the steel screw steamer *Zeeland* was taken on her speed trials on the river Maas. She is owned by Messrs. The Shipping and Coal Co., of Rotterdam, whose fleet of steamers now numbers six, and has been built by Messrs. Rykee & Co. She is of the following principal dimensions—230 ft. long, 34 ft. beam and 17 ft. deep, and fitted with triple-expansion engines of the latest design, having cylinders 17½ in., 28 in. and 45 in. dia. and 36 in. stroke, steam of 180 lbs. pressure being supplied by two large single-ended boilers. The machinery has been built by Messrs. Wilton's Engineering and Slipway Co. under the supervision of Messrs. Flannery & Gregson, of Rotterdam, London and Liverpool, the owners' superintending engineers, and worked during the trials without a hitch. Four runs over the measured mile were taken and a mean speed of nearly 10½ knots obtained, this being above the contract speed. The vessel is of the self-trimming type and built to Lloyd's highest class, and is fitted with all the latest improvements for rapid handling of coal or other cargoes. She is expected to carry 1700 tons on a mean draught of 15 ft. At the conclusion of the trials the vessel proceeded to her loading berth to receive her first cargo.

Burnhope.—On September 24th, the fine new steel screw steamer *Burnhope* (of which we gave particulars in our September issue, page 77), built by Messrs. Wood, Skinner and Co., Ltd., of Bill Quay-on-Tyne, to the order of Messrs. The Burnett Steamship Co., Ltd., of Newcastle, left the Tyne for her official trial trip. The propelling machinery, which has been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple-expansion engines, having cylinders 20 in., 33 in. and 54 in. with a stroke of 36 in., steam being supplied by two large steel boilers, working at a pressure of 180 lbs. per square inch. On the measured mile the engines attained a speed of 11¼ knots, the machinery working throughout without the slightest hitch, and gave great satisfaction to all concerned. Amongst those present on the run were Mr. N. Burnett, under whose supervision both hull and machinery have been constructed, Mr. Jas. and Mr. Leslie Skinner, representing the shipbuilders, and Mr. D. Myles, representing the engine builders. We may say that Messrs, The North-Eastern Marine Engineering Co., Ltd., have engined all the seventeen vessels built by Messrs. Wood, Skinner & Co., Ltd., for Messrs. The Burnett Steamship Co., Ltd.

Celebes.—On September 25th, the large Dutch steamer *Celebes*, which has been built to the order of Messrs. The Stoogvaart Maatschappij "Nederland," of Amsterdam, by Messrs. Furness, Withy & Co., Ltd., West Hartlepool, proceeded on her official trial trip from the Tyne. The vessel exceeds 407 feet in length, and has a measurement capacity of 11,725 tons, built to highest class in Bureau Veritas. She is of the three-deck type with two steel decks laid, shelter deck erections sheathed with teak all fore and aft, and a long boat deck above also built of teak. A cellular double bottom is fitted throughout for water ballast, the fore and after peaks being also available as tanks. Six water-tight bulkheads divide the vessel into seven water-tight compartments. Special attention has been given to all discharging gear, the ship being equipped with twin masts, four derrick posts (the latter arranged as ventilators), twelve derricks and twelve powerful steam winches. These, together with six large hatchways, greatly facilitate the quick discharging of cargo. One twenty-ton derrick will also be fitted to deal with heavy weights. The equipment also includes large multitubular donkey boiler, direct steam windlass, patent Telemeter gear, electric light installation by Messrs. Furness, Withy & Co., Ltd., patent fire-extinguishing apparatus. Accommodation is provided for captain and officers in a large steel deck-house amidships, and the crew are berthed in the forecastle. Hospitals and galleys, etc., for natives are arranged on the shelter deck aft. Awnings are arranged all fore and aft. The machinery worked most efficiently throughout the trials, and has been supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool,

the sizes of cylinders being 26½ in., 43 in., 72 in. by 48 in. stroke, steam being supplied by three single-ended boilers 11 ft. 3 in. by 14 ft., having a working pressure of 180 lbs. Messrs. Jonckheer, J. de Bruyn Kops and L. Burger represented the company, and Messrs. H. Withy, G. W. Sivewright and L. D. Wingate represented the builders. The vessel attained a speed of 13 knots.

Jeanara.—On September 25th the large steel screw cargo steamer *Jeanara* (of which we gave particulars in our October issue, page 116), built by Messrs. David & William Henderson & Co., Ltd., Partick, to the order of Messrs. Maclay and MacIntyre, of Glasgow, underwent a successful trial trip on the Firth of Clyde, when a mean speed of 12½ knots was easily attained between the Cloch and Cumbrae Lights. During the trials everything passed off to the satisfaction of owners and builders.

Elterwater.—On September 26th, the screw steamer *Elterwater* (of which we gave particulars in our October issue, page 115), built by the Blyth Shipbuilding Co., Ltd., for Messrs. The Elterwater Steamship Co., Ltd. (Messrs. Sharp and Co., managers), of Newcastle-on-Tyne, was taken to sea for trial. Triple-expansion engines of good power have been fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Sunderland; cylinders 19 in., 31 in. and 51 in. by 36 in. stroke, one boiler 16 ft. by 10 ft. 6 in., working at 180 lbs. pressure. The *Elterwater* was run several times over the measured mile and good results were obtained, the representatives of owners, builders and engineers on board being highly satisfied with the speed, also the smooth working of machinery. The hull and machinery have been built under the supervision of Mr. Jos. R. Scott, of Newcastle-on-Tyne.

Caceres.—On October 2nd, the twin-screw steamer *Caceres* ran her trials on the Forth. She has been built by Messrs. Mackay Bros., Alloa, and engined by Messrs. Aitchison, Blair & Co., Clydebank, for the Lloyd Brazileiro. Under loaded conditions a full power speed of 11·7 knots was obtained, and thereafter the vessel steamed for several hours at her guaranteed speed of 10 knots. The trial was superintended by Dr. Rosauro de Almeida on behalf of the owners. The vessel is supplied with Cochran (Annan) donkey boiler 6 ft. diameter, 12 ft. 3 in. high, 350 square feet heating surface, fitted with the Cochran patent seamless furnace.

Helena.—On October 2nd, the steel screw steamer *Helena* (of which we gave particulars in our October issue, page 114), built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of A. C. Lensen, Esq., of Terneuzen, was taken to sea for her trial trip, which proved highly satisfactory. During the run from Hartlepool Heugh to Souter Point everything worked with the greatest smoothness, and a speed of close upon 11 knots was maintained. The owner, Mr. Lensen, and Mr. W. C. Carter, of London (the superintendent engineer), both expressed themselves as being highly pleased with the ship and engines. After the trial trip the vessel proceeded to the Tyne under command of Captain Meinsma. The *Helena* is a duplicate of the *Elisabeth*, recently built for the same owner, by Messrs. Craig, Taylor, and Co., Ltd. The vessel is supplied with a Cochran (Annan) donkey boiler with patent seamless furnace.

Echunga.—On October 3rd, the steamship *Echunga* (of which we gave particulars in our September issue, page 76), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesbrough-on-Tees, proceeded to sea for her official trials, which passed off in a most successful manner, attaining 12½ knots, and the vessel returned to the Tees, whence she will sail to Cardiff and London to load for Australia under the command of Captain Thos. M. Allen. Messrs. R. J. Bruce & Co., of Hull, have coated the bottoms of this vessel and the steamship *Urilla*, belonging to the same line, with their "Nomos" composition. The hull and engines have been constructed under the superintendence of Captain Charles Dingle and Mr. James Stewart, of Newcastle-on-Tyne, as consulting engineer. Messrs. S. T. Taylor & Sons have covered boilers, pipes, etc. with their "Tynos" non-conducting material.

Karanja.—On October 5th, the steamship *Karanja* (of which we gave particulars in our October issue, page 115), a finely modelled self-trimming collier, built by Messrs. Robert Thompson & Sons, Ltd., at their Southwick Yard, to the order of the Union Steam Shipping Co., Ltd., of London, was taken out to sea for her official trial. After adjusting compasses the speed trials were run on the measured mile off Whitley, when a mean speed of over 10½ knots was easily attained, the engines running with the utmost smoothness. There was a large company on board, including Mr. C. W. Gordon, Mr. C. Wilfred Gordon and Mr. C. T. Kendall, representing the owners, and Mr. C. H Thompson and Mr. Hildrey, representing the builders. After the trial, Mr. C. W. Gordon on behalf of the owners, expressed himself highly satisfied with the vessel.

Spheroid. On October 5th, the new screw steamer *Spheroid* (of which we gave particulars in our September issue, page 77), built by Messrs. John Readhead & Sons, West Docks, South Shields to the order of Messrs. Scrutton, Sons & Co., London, for their direct line, proceeded to sea on her official trial trip. After the trial, which was in every way satisfactory to all concerned, the vessel left for Cardiff under the command of Captain Norris. This is the seventh vessel built for the above firm by Messrs. John Readhead & Sons.

Mars.—On October 9th, the steel screw steamer *Mars* (of which we gave particulars in our September issue, page 75), proceeded on her official trial trip off Hartlepool. She has been built to the order of Messrs. Harris & Dixon, Ltd., London, by Messrs. Furness, Withy & Co., Ltd., Hartlepool. The machinery and boilers have been supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, and worked most efficiently throughout the trial. The owners were represented by Mr. H. M. Rogers (London), the shipbuilders by Mr. F. Bolton, and the engineers by Mr. G. Urquhart.

Ladywood.—On October 12th, Messrs. Osbourne, Graham and Co., of Hylton, sent to sea for her official trial the steel screw steamer *Ladywood* (of which we gave particulars in our October issue, page 116), specially constructed to the order of Messrs. Wm. France, Fenwick & Co., Ltd., of Sunderland and London, for their well-known trade. The trial was in every way satisfactory, a mean speed of over 10 knots being easily attained. Messrs. S. T. Taylor & Sons have covered boilers, pipes, etc., with their "Tynos" non-conducting material.

Lady Blanche. The new steam yacht *Lady Blanche* (of which we gave particulars in our September issue, page 78), launched by Ramage & Ferguson, Ltd., Leith, for Mrs. Valentine Smith, has completed her trials on the Firth, when a mean speed of over 13 knots was obtained on the measured mile. The machinery during the trials worked in the most satisfactory manner. This yacht has been built to the designs of Cox & King, London, and holds the record of being the largest yacht constructed to the order of an English lady.

Orsova. On October 15th, the large steel screw steamer *Orsova* (of which we gave particulars in our October issue, page 116), built by Messrs. R. Craggs & Sons, Ltd. Tees Dockyard, Middlesbrough, for the Hungarian Levant Steamship Co., Ltd., of Budapest, proceeded to sea to complete her official trials in a loaded condition. The results were pronounced entirely satisfactory to all concerned, the vessel registering a speed of over 10¼ knots during a continuous run extending over six hours.

"Ibo." This new steamer belonging to the Empreza Nacional Nav à Vapor, of Lisbon, is being coated by Messrs. R. T. Bruce & Co., of Hull, with their "Nomos" composition.

Messrs. Jas. Pollock, Sons & Co., Ltd., of Lloyd's Avenue E.C., send us a well-got-up catalogue referring to steamers of various classes which they have supervised and built for owners. Besides general views we find in many cases a skeleton plan and elevation and general particulars, with price of each vessel appended. There are fifty-nine illustrations in all, and though most of these are of steam-propelled vessels, many are motor-driven launches and tugs; lighters and barges are also shown, and among special service craft, we notice stern wheelers, steam trawlers, bucket and suction dredgers hopper barges and floating dock. We have enumerated some of the features of this catalogue, which is of an all-round good character and likely to be of service to buyers abroad. Code words are found in most cases with the other particulars. Finally, we have a copy of agreement the firm adopt with their clients, suggestions for ordering and a special code, finishing up with a general index of contents.

BOARD OF TRADE EXAMINATIONS.

Note—1C denotes First Class; 2C Second Class.

August 24th, 1907

Greenwood, R. 1C W Hart'l
Harrison, Tom 1C W. Hart'l
Haylett, A A... 2C London
Heald, Wm D 2C Cardiff
Henderson, Wm. H. 2C Glasgow
Hogg, Wm H 1C N Shields
Johnston, H B. 1C Barrow
Kermeen, R. W. 1C Liverpool
Knapper, Chas. 2C Cardiff
Kydd, Frank .. 2C Glasgow
Lane, Robt W. 1C London
Liddell, A R .. 2C Leith
Lowther, H .. 2C Liverpool
McNaught, D. McL 2C Glasgow
Milligan, D G 1C Liverpool
Mitchell, G H. 2C Plymouth
Mitchell, P McR. 2C Leith
More, Geo. A... 2C N Shields
Morgan, C. G. V 1C Cardiff
Naylor, A E .. 2C Cardiff
Nicol, John .... 1C London
Preston, Frank 2C Cardiff
Reid, David.... 1C Glasgow
Riddel, Robt... 1C Glasgow
Riordan, M .. 2C Cork
Sainsbury, S H 1C Cardiff
Sharp, Alf G. 2C Liverpool
Sladen, Fred. S 2C Cardiff
Snaith, F. H... 1C N. Shields
Taylor, F. R. .. 1C Liverpool
Trenchard, L... 2C Cardiff
Tuckett, Reg... 1C N. Shields
Ward, P J. G 2C Glasgow
Wardman, S. J. 2C W. Hart'l
White, John W 2C Glasgow
Wilson, William 1C Glasgow
Wilson, P. H... 1C N. Shields
Woodier, H. A 2C Liverpool

August 31st.

Allen, James .. 2C N Shields
Atkinson, W A. 1C Sunderl'd
Coggings, S J. 1C Hull
Collinson, R B 1C Sunderl'd
Craigen, R. M. 1C Aberdeen
Dawkins, Wm. 2C N Shields
Dunk, A J .... 2C Bristol
Forbes, Walter 1C Liverpool
Foster, Alf R. 2C Sunderl'd
Furlong, R H. 1C Liverpool
Galloway, N D 1C Liverpool
Gow, Fred .... 2C N Shields
Hamilton, John 2C Greenock
Harvey, E. W 1C London
Hastie, Geo H 2C N Shields
Heck, Wm D 1C N Shields
Holmes, W C 1C London
Irving, John .. 1C London
Keith, Henry .. 1C Sunderl'd
Kilgour, James 2C Aberdeen
Mathias, E G 2C Greenock
Philips W F 1C Bristol
Poole, Robert 2C Liverpool
Pybus, A E .. 2C Sunderl'd
Raddings, Joe.. 1C Hull
Robertson, C G 1C Aberdeen
Ruxton, Wm .. 2C London
Scott, Robert .. 2C N Shields

Sherwin, S W 2C London
Smith, H H. .. 2C Hull
Sparks, F. M. .. 2C London
Theodorides G J. 2C Greenock
Thirwell, Walter 2C Sunderl'd
Thomson, G J. 2C Greenock
Walker, John G 2C Aberdeen
White, Harold 2C Liverpool
Williams A. W 2C Aberdeen
Woodcock, R R. 2C Liverpool

September 7th.

Alexander, D .. 2C Glasgow
Anderson, A C 2C Liverpool
Ball, Wm. G .. 2C South'ton
Birkley, Geo. S 2C Cardiff
Black, William 2C Cardiff
Boxall, Edw. W 2C Glasgow
Bunting, L. W. 2C Liverpool
Butler, Saml. A 2C Glasgow
Craig, Robt. G. 1C Liverpool
Currie, Arch. .. 2C Leith
Davies, M O .. 2C South'ton
Duncan, Robt 2C Liverpool
Fish, Thos. .... 2C Liverpool
Gill, Wm J .. 1C London
Goellnicht, L E 2C Glasgow
Goodacre, E. J. 2C London
Glycas, A. .... 2C Leith
Hollings, A A. 2C N. Shields
Howe, Ernest .. 2C London
Jones, Robt. .. 2C Liverpool
Jordan, Michael 1C London
Laverock, A. S 1C London
Locke, D A. .. 1C London
Lockhart, H .. 1C Glasgow
Lockyer, A S . 1C South'ton
Mackie, W. R. N 1C Glasgow
MacRae, J. McB 2C Glasgow
Mactaggart, J .. 1C Glasgow
Maddin G. A . 1C South'ton
M'Donald, R... 1C Glasgow
M'Hugh, Geo 2C N Shields
M'Intosh, Alex 2C Glasgow
Mundell, Bruce 1C Liverpool
Ogle, Wm. D 1C N. Shields
Pike, George .. 2C N Shields
Polychroniadis, L. S 1C London
Poyner, John F 1C Liverpool
Ritchie, W. W 2C Glasgow
Scott, Herbert 1C Cardiff
Scully, Alex .. 1C Liverpool
Skitch, G W 2C Glasgow
Smith, Jas P... 2C London
Thomas, Edwin 1C Cardiff
Thomas, R. R 2C Cardiff
Webster, Albert 1C Liverpool
White, Jas P.. 1C N Shields
Whitehead, Robt. W 1C N Shields
Wood, Peter .. 2C N Shields
Young, R L. .. 1C N. Shields

September 14th

Angus, Alex N 2C Greenock
Austin, G C .. 1C London
Barwick, Lyle.. 1C Liverpool
Bird, William.. 2C N Shields
Butler, Robt L. 1C Liverpool

Cornwall, Geo. 2C Liverpool
Cosgrove, Thos. 1C London
Durie, Alex. D. 1C N. Shields
Ferguson, Peter 2C Greenock
Gracie, G P. B. 1C Dundee
Hacklett, A. H. 1C London
Hay, Sweton F 1C London
Hughes, J. J. .. 2C Greenock
Huntress, T. J. 2C N Shields
Hynd, David B 2C Dundee
Ireland, George 2C Dundee
Lambert, Geo. 1C N. Shields
Leslie, John .. 1C Dundee
Lemeire, G. N 1C London
Little, Samuel 2C N Shields
Marot, John H. 2C N Shields
McClelland, H. E 1C Liverpool
Mudie, D G. .. 2C Dundee
Murray, Jas. L. 1C Liverpool
Paisley, Peter.. 2C Liverpool
Pennycock, Geo. 1C Liverpool
Prain, I. McL .. 1C Dundee
Rabaey, F L... 1C London
Shuttleworth, W 2C N Shields
Smith, Percy W 2C London
Stuart, Alex J 2C Dundee
Sutherland, J. P. 1C Liverpool
Watson, Harold 1C Liverpool
Watson, A. W 1C Dundee
Watson, Wm .. 2C Hull
White, Robt. A. 2C Dundee
Williams, J. C. 2C London
Wynd, David F. 1C Dundee
Young, D. H. .. 2C Dundee

September 21st.

Atkin, Albert E. 2C Liverpool
Audley, R. W 1C Liverpool
Blundun, A. B. 2C London
Calder, Alex. .. 2C Leith
Campbell, K. .. 1C South'ton
Clemo, R H C 1C Plymouth
Coffer, David G 2C N Shields
Davis, Alfred C. 2C Cardiff
Fitzpatrick, J. 1C Barrow
Fleming, David 2C Liverpool
Gordon, W. T 1C W. Hart'l
Grant, Charles 1C Glasgow
Gray, William 1C W. Hart'l
Hamilton, Jos. 1C London
Holtzman O B. 2C South'ton
Hourston, Geo 1C Leith
Jefferies, Edwd. 1C Leith
Johnstone, G F. 2C Barrow
Keegan, T F .. 2C Barrow
Kirk, Chas. S 2C W Hart'l
Lewis, Watkin 2C Cardiff
Lowson, C. F 1C Leith
Mackay, Thos 1C Glasgow
MacWatt, A .. 1C South'ton
Mallam, Alf S. 1C Cardiff
McAleer, Robert 1C N. Shields
McFee, William 2C London
Nelson, Ralph B. 2C London
Nielson, Jas W 1C Glasgow
Oliver, Alex. T 2C W Hart'l
Owen, Norman 2C Cardiff
Patterson, Wm 2C Liverpool
Platt, Joseph .. 1C Liverpool
Porritt, Albt E 2C W Hart'l
Prout, John.... 2C South'ton
Ritchie, David 1C Cardiff
Sharp, Leon. A 1C N. Shields
Sharp, Wm G 1C Glasgow
Skelley, F G .. 2C Glasgow
Skyrme, Abm.. 2C Cardiff
Taylor, Edward 1C London
Thompson, G 2C W Hart'l
Trechmann, O J 1C W Hart'l
Weeks, C A R. 1C London
Westin, Olaf .. 2C N. Shields

Wilcox, W. H. 1C Cardiff
Williams, Thos. 1C Liverpool

September 28th.

Abraham, W. E. B. J 2C N. Shields
Alcock, F. G. .. 1C Aberdeen
Barker, T. D. .. 1C London
Bowden, W. J. 2C Bristol
Brown Edward 1C Liverpool
Carr, Raymond 2C Sunderl'd
Charles, C. S... 1C Aberdeen
Couch, N S .. 1C Liverpool
Downes, J. L... 1C Sunderl'd
Edwards, Harry 1C Liverpool
Grimoldy, Geo. 2C London
Hardie, John .. 2C Aberdeen
Hewett, Wm. L. 2C Sunderl'd
Hunter, Alfred 1C Sunderl'd
Hunter, Wm. L. 2C Greenock
Jones, Hubert.. 2C Liverpool
Jones, Joseph G. 2C London
Leslie, Walter S. 2C Aberdeen
Little, James .. 2C Greenock
Luke, Rich W. 2C Bristol
Milne, E. W. .. 2C Aberdeen
Mollison, R .. 2C Aberdeen
Nicholson, E H 2C Hull
Perry, Thos. .. 2C Liverpool
Potter, Albert O. 2C Bristol
Pook, Walter F. 2C London
Robertson, C. L. 1C Aberdeen
Robertson, W. A. L 1C Aberdeen
Smith, Wm C 2C Aberdeen
Starkey, F. J .. 2C Hull
Stevenson, R. L. 2C London
Warren, A J .. 1C Sunderl'd
Wilson, John W 2C Liverpool
Wright, L. W. 1C N. Shields

October 5th.

Barnet, Eben... 1C Glasgow
Coates, S. B. .. 2C Belfast
Cochrane, W. McN. 2C Glasgow
Chandler, F W 2C Liverpool
Cormack, Thos. 1C Glasgow
Daish, H. H. R. 1C N Shields
Drummond, W. 2C Leith
Dudgeon, A H. 1C Liverpool
Dudgeon, Stan. 2C N. Shields
Dunn, Robt. J. 2C London
Flucker, T. C. 2C Leith
Fisher, Cuth. E 1C Liverpool
Fyfe, James .. 2C London
Gales, F J. S 1C Liverpool
Gander, Jas S. 2C London
Grant, D C. .. 1C Glasgow
Gray, Walter B. 2C Leith
Harvey, Thos 2C Liverpool
Hunt, John .... 1C Cardiff
Johnson, R W 2C N Shields
Kellar, W H .. 1C Glasgow
Lavis, Fredk C 1C Liverpool
Lawson, Geo 1C Glasgow
M'Call, Robt 2C Glasgow
M'Lennan, D B. 2C Glasgow
Moore, Wm A. 2C Belfast
Norman, Henry 2C Liverpool
Pettigrew, Jas. 1C Leith
Rees, Ivor H .. 2C Cardiff
Ridley, Jos W 2C Glasgow
Salter, Wm. C. 2C London
Smailes, James 2C N Shields
Smith, Harry .. 2C Liverpool
Stein, Wm M 2C Glasgow
Stewart, Peter 2C Glasgow
Thompson, J H. 1C Belfast
Thorburn, John 1C London
Tweedie, N E L 2C Glasgow
Wickes, John W. 2C London

The Marine Engineer
And Naval Architect.
LONDON, DECEMBER 1, 1907.

FOUNDRY EXPERIENCES

As foundries have been an adjunct to engineering works of any magnitude, we have much pleasure in drawing attention to the paper upon "Some Foundry Experiences," read by Mr. A. R. Ballamy, of Stockport, before the Manchester Association of Engineers, in which he lays out from his own experience what must be borne in mind on starting such an engineering foundry. It is first to be considered whether a foundry can be successfully managed as part of a manufacturing engineering business; and when it is considered that the regular supply of good castings, which must be accompanied by the reduction of cost and the improvement of the castings, it would appear to be well worth while to adopt such a foundry as a part of a well-organized engineering business. Then must be considered the best site for the foundry in relation to the works and the surroundings, after which must follow the management and division of the labour, whilst power and light for the foundry and a proper system of charging accounts with the cost of production must follow. It is to be borne in mind, in order to determine whether a foundry can be successfully managed as part of an engineering business, that the founder's art is one requiring the best personal attention. As the production of castings is, after all, the production of raw materials, it is to be admitted that such a business may be managed by men who are not expert moulders, and who have had no experience in the choice of pig-iron, which goes to form the castings. If this be so determined by the principals, they must remember that very often the delay caused to engineering works for the want of particular castings, which form part of the contracts that the works have to produce, is sufficient to cause serious loss in the contract. It is to be noticed when the castings are ordered from elsewhere that the first castings that are sent in are those which make weight, and that other difficult and light parts are much delayed. The question of a suitable reduction in the price of castings will depend upon whether there is a good deal of repetition work, and which may perhaps last for years. It is here that the foundry which can afford to lay down special plant for this repetition work will find their pockets much enriched by this proceeding. It must be remembered that places outside the works do not even know to what extent the special work will be required, and are not likely to lay out special tools for its production. It must be remembered that the works foundry has no object in increasing the weight of castings it produces, whereas outside foundries are well known to increase the weight of their castings by rubbing down the cores. When the building of a foundry as an adjunct to engineering works has been decided upon, it must be that the foundry shall have spacious open yards at both ends if possible, and the general plan be that all raw material is delivered in the yards at one end, and that all finished castings are to be despatched from the other end, which must be handy for the foundry stores and the machine shops. The best design for a foundry producing light and heavy goods is to have one or more middle bays for the heavy castings, with other further bays of a lighter design for the small castings, bench moulding and core making. To such a foundry the roof should be of glass and slate with extensive ventilators. The floor of the middle bay should be covered with sand to a depth of about two feet. It is a good plan to have anchor bolts to which top boxes can be fastened to prevent them rising, so as to save numerous heavy weights, which are cumbersome and inconvenient. It is well that there should be a good deal of glass in the roof, so as to give the whole foundry a well-lighted appearance. It must be remembered that as the floor is chiefly black it reflects little light, so that it depends upon direct lighting to appear well lighted. As to division of labour, it is well to have a head foreman who must be under a works manager, and the head foreman should have the responsibility of appointing the under foreman and should be consulted upon all materials used for the foundry. Whether this arrangement can be improved by the appointment of a metallurgical chemist is an open question, as in this case there would be a dual responsibility, which is never satisfactory. As to the supply of power to the foundry, if it can be arranged that a supply of power from the works can be passed on to the foundry this will be a very convenient arrangement. As the foundry requires power in many forms, it will be found inconvenient to attempt to drive everything in the foundry direct from shafting. Electric power will be found very serviceable and handy for a number of purposes apart from the travelling cranes. If moulding machines are used compressed air or hydraulic power is necessary. The question as to what light should be used for the foundry is a matter of some consideration. Gas-lights, whether simple or incandescent, are very inefficient, the incandescent gas mantle being soon choked with dirt. The ordinary arc lamp does not show to advantage in the atmosphere of a foundry, but it has been proved that the new powerful yellow light from certain arc lamps has turned out the best. As to equipment, two cupolas should be used with solid bottoms; the use of a drop bottom is found to be disadvantageous, owing to its giving way through being imperfectly closed or due to wear. The air supply to the cupolas is provided through two rows of tuyères, one above the other. The top series can be put in use when beginning to blow, and when the metal begins to melt the bottom

series is opened and the top set reduced or shut off. The range of fuel for good cupolas should amount to from $1\frac{1}{2}$ to 2 cwt. of coke per ton of iron. For these cupolas a cupola hoist should be used for the raw materials. An electric hoist has been tested, and, though it gave an advantage in economy, it was always getting out of order, and it was found better to use a direct-acting air-hoist, as it is simple and reliable and requires practically no attention. To these tools must be remembered the core stoves, jib cranes, rattlers and moulding machines, of which some account is given in the paper in question, with some good examples of foundry accounts and post-cards for orders.

HULLS AND MACHINERY OF VESSELS

THE two papers contributed to the Institute of Marine Engineers,—and tactfully written by Mr. Robert Elliott, B.Sc.,—in October and November, are of a character at once valuable intrinsically and profitable for discussion. The author is one of Lloyd's Register Surveyors, and has had many opportunities of noting under different conditions the styles adopted by builders in the construction of the hulls of vessels, as well as the policies which rule in the up-keep whether of cargo or passenger steamers. The members of the Institute are to be congratulated upon having such eminently practical papers put before them to pave the way for the exercise of thought and interchange of experience, as herein lie the main and legitimate ends of papers read before a Society of practical men. The first paper deals with repairs to the hulls of vessels, whether these be necessitated by the exigencies of circumstances due to tear and wear, to defects arising from inherent and concealed flaws, or to accidents; the suggestions and hints conveyed in the various paragraphs should prove of considerable value. The second paper treats of the machinery, with special reference to the more vital parts; and here again Mr. Elliott deals with the subject in a manner which is full of suggestiveness. In the discussion, which we note was adjourned till Monday, December 16th, there ought to be a wealth of information dug out of the mine of experience for the store house of the membership, in the transactions.

Underwriters' Appreciation. Readers will perhaps remember the case of the breakdown at sea and repair of the thrust shaft of the Donaldson Liner *Hestia* in January last, an account of which was given in our issue for March last. This notable case of repair at sea, done under disadvantageous circumstances, has now been recognised by the underwriters, who have awarded the first engineer (Mr. Angus A. Urquhart) [illegible] second engineer £12, third £10 and fourth £8, [illegible] which does not err on the side of liberality considering the skill evinced and the value of the vessel brought safely into port.

For want of space we are compelled to hold over the [illegible] on "The Screw Propeller" and Electricity on Board [illegible] until our next issue.

MEYER'S LIQUID FUEL APPARATUS.

ALTHOUGH the subject of liquid fuel has received a considerable amount of attention of late years, and much advance has been made in the practical application of this class of fuel to steamships, it cannot be said that we have by any means heard the last word on the subject, as may be exemplified by the fact that a new arrangement has been devised by Mr. R. A. Meyer, formerly Superintendent Engineer of the Royal Dutch Packet Company in the Dutch East Indies. This system has been applied with much success on the vessels of this company, and we understand the boiler-rooms are examples of cleanliness and the products of combustion are almost colourless. Mr. Meyer is now the Marine Superintendent of the Anglo-Saxon Petroleum Company, and one of the first things he did on his appointment was to fit his system on the steamers of this company, the work in connection with which was entrusted to the Nederlandsche Fabrick van Werktuigen and Spoorweg-Materieel, of Amsterdam.

As we are sure our readers will be interested in the subject, we have pleasure in describing and illustrating the installation fitted on the s.s. *Romany*, a petroleum vessel of 1500 I.H.P. and a speed of 10 knots.

By reference to the illustrations it will be noticed that Fig. 1 is a perspective view of the oil-heating, filtering and pumping plant. Fig. 2 is a sectional view of one of the heaters, showing the method of supporting the tubes therein. Fig. 3 is a part-sectional view of one of the quadruple burners used on each furnace. Fig. 4 shows some of the furnace fronts in the shop ready for fitting to the boiler furnaces. Fig. 5 shows details of the furnace fronts, furnace, combustion chamber and draught-control devices. Fig. 6 shows in three views the apparatus illustrated in Fig. 1.

It may be said that the feature of the system is the distribution of the oil as a spray in the furnace in a heated condition and under the pressure from an oil-pumping plant.

It will be noticed that the pumps are in duplicate, one being for use while one is in reserve. There is one suction heater having two filters, one of which can be used while the other can be cleaned. There are also two delivery heaters, of which one is always in reserve. The general construction of these heaters is shown in Fig. 2; each consists of a chamber within which heating pipes are arranged, the suction heater having its duplicate filters arranged one on each side, as shown in Fig. 6. Steam is supplied through the pipe 1, and passes through the three stop-valves and pipes 2, 3 and 4 to the coils of the delivery and suction heaters, and leaves them by the pipes 7 and 8 connected to the main exhaust pipe 10, which also takes the exhaust pipe 9 of the pumps. Live steam is admitted to the pumps through the pipe 5.

The pipes from the various fuel tanks in the vessel are led to a distributing box having a stop-valve for each tank, and this box is connected to the pipe 11 communicating with the suction heater. The pump sucks the oil through the pipe 12 from the filter out of the suction heater, and delivers it through the pipe 13 to the one of the delivery heaters in use, and vided at its end with a screwed portion by which the oil under pressure is sprayed into the furnace. The fuel delivered is regulated by the stop-valve of each jet, and any excess delivered by the pump is discharged through the spring-pressed bye-pass valve back to the suction heater, so that the stokehold regulation can be carried out without reference to the speed of

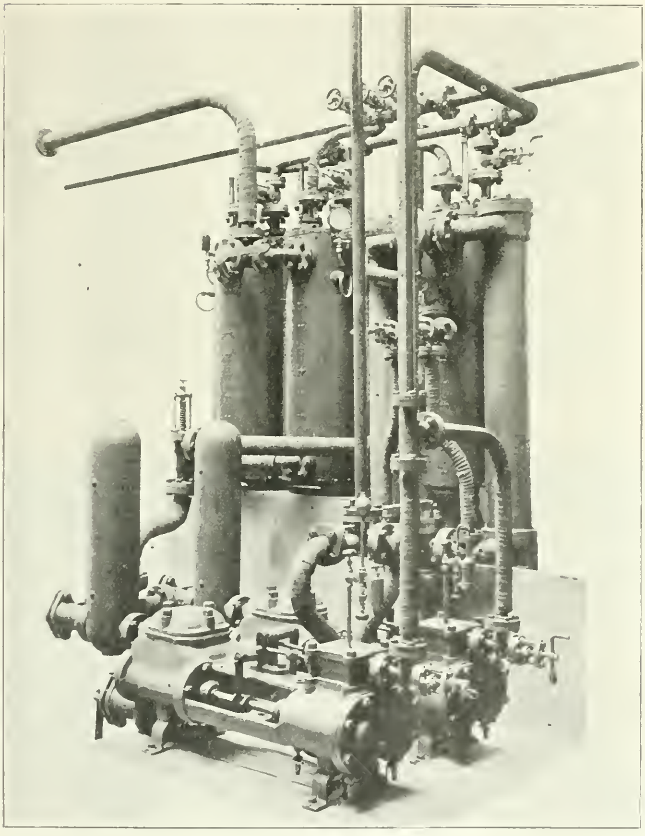


Fig. 1.

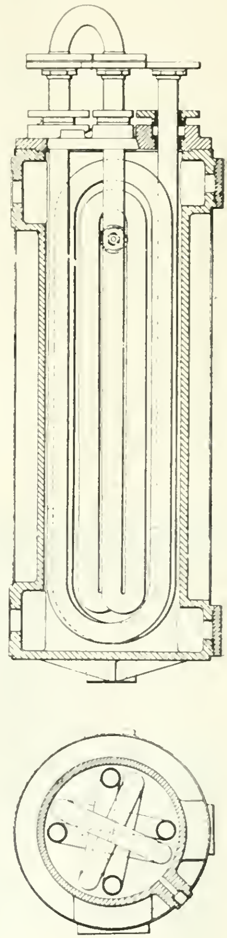


Fig. 2

thence through the pipe 15 to the furnaces. Each furnace is provided with a distributing box having four valves and four jets, *viz.*, one valve for each jet. By reference to Fig. 3 it will be seen that each jet consists of a nozzle having a needle spring pressed into place by a spring and end cap, and is also pro- the pumps, although naturally this latter is regulated under running conditions just above the maximum demand for the sake of economy.

Turning now to the furnace itself, it will be noticed that the front is fitted into the furnace tube so as to leave an annular space between the front and the

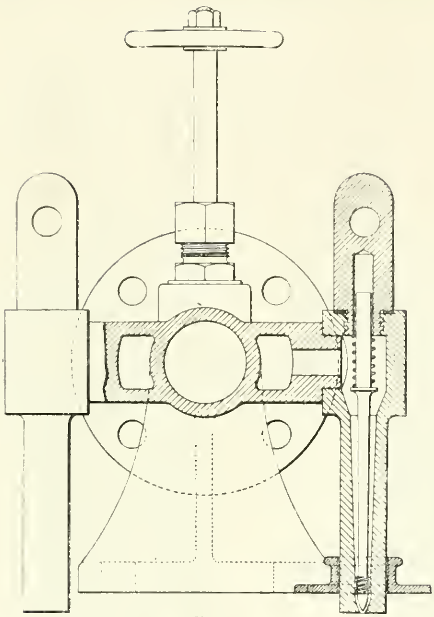


Fig. 3

furnace tube, while the periphery of the front has angularly disposed ribs by which the air is heated in its passage through the annular space. Upon the furnace front and covering the annular space is a ring damper having a screw arranged on its inner surface, which co-acts with studs on the furnace front having the function of a male screw. On the ring being rotated by the handle, as shown on the right-hand side of Fig. 5, the face of the ring can be brought up to, and be receded from, the furnace front, so that the area of the air-passage can be regulated at will.

In order to obtain a further supply of heated air in the vicinity of the fire-bridge, some of the screwed stays in the back of the combustion chamber are in the form of tubes through which air enters and, passing along a fire-brick channel, is heated, and, finally passing through holes in the bridge, it comes in contact with the furnace gases. The arrangement of the bridges or baffles is clearly shown in the sectional view Fig. 5, and requires no further description.

When it is desired to use coal instead of liquid fuel the burner fitting is removed from the fire door, the cast-iron damper is replaced by an ordinary plate damper, and the furnace is furnished with the usual dead-plate, fire bars and bridges, an operation taking a relatively short time.

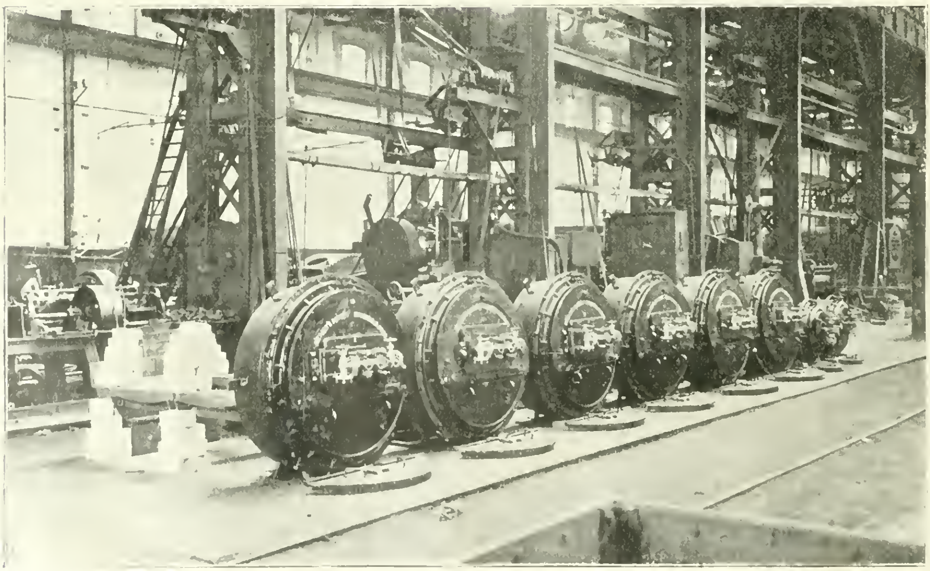


Fig. 4

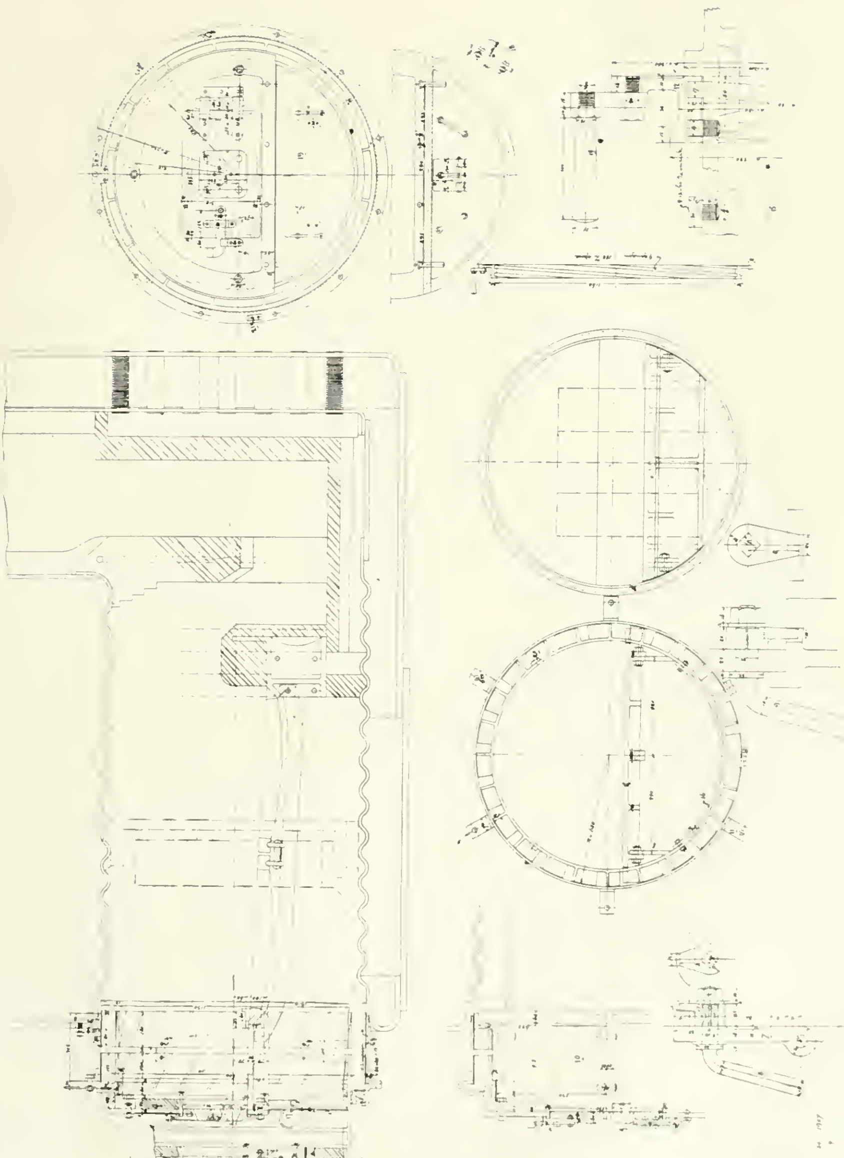
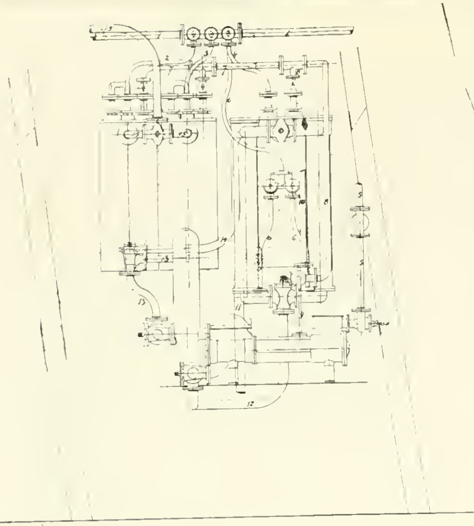
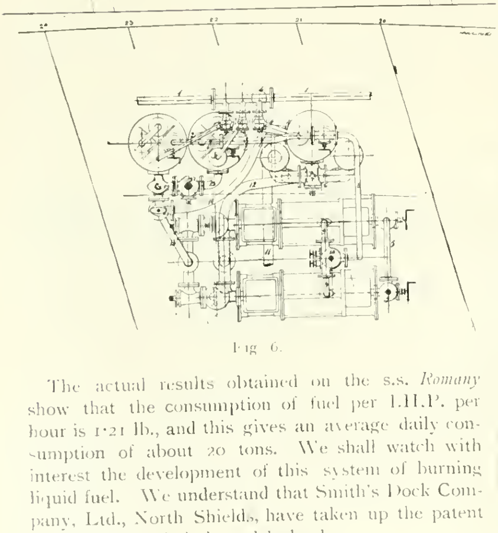


Fig. 5

Meyer's Liquid Fuel Apparatus.





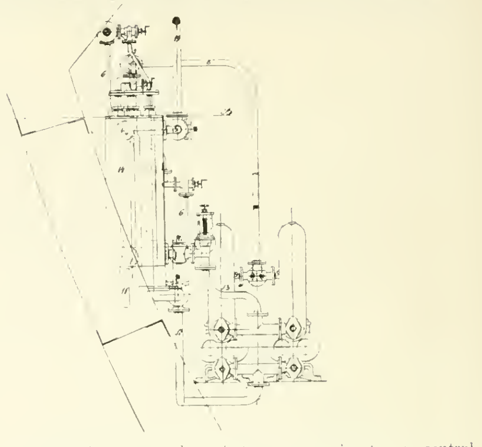


Fig. 6.

The actual results obtained on the s.s. *Romany* show that the consumption of fuel per I.H.P. per hour is 1·21 lb., and this gives an average daily consumption of about 20 tons. We shall watch with interest the development of this system of burning liquid fuel. We understand that Smith's Dock Company, Ltd., North Shields, have taken up the patent rights in Great Britain and Ireland.

BYE-PRODUCTS OF THE ENGINE ROOM.

II.

In this ultra commercial age, when everything is tuned to the highest pitch of economy and every diapason between capital and interest is tested and measured on the scale of profit and loss, no detail is too insignificant to warrant neglect, no item too small to create a discord.

The majority of land power plants are more favourably situated towards economising in details than are those afloat. The space limits are not so stringent and other facilities are more adaptable, hence minor savings have crept in which are not so easily applicable to marine work. In some instances, however, a fleet of steamers running to one central port offers a somewhat similar analogy, and by the consolidation of the units a considerable gain may be effected.

It is some time since there was put on the market a machine for the extraction of the oil out of soft materials, which having fulfilled their prime functions with relation to the lubricant were formerly thrown out of use. Where large quantities of filter and sponge cloths, waste and the like were used, any such appliance that could reduce the consumption was eagerly sought after, became widely adopted and by its very presence gave incentive to the preserving of anything that could be treated by it. Further, the retention of the lubricating medium, to be used again, allowed of a higher class of oil being employed with beneficial results.

The most important aboard ship of the oil retainers are feed filter cloths and waste, particularly the latter used in "wiping down"; to these, with turbine engines, must be added oil filter cloths and the surplus which exudes from the oil pumps, main bearings and thrust blocks, together with the collected material when cleaning any of these. There are other smaller tributaries to this oil stream which all add their quota such as syphons and lickers oil boxes and save-alls.

The aggregate of these atoms multiplied by a number of regular producers may well merit the trial of such an apparatus that has made its home in the large power stations, has forced its way into individual manufactories, and is gaining admittance into the still smaller plant of shipyards and engine works.

Briefly, the principle of operation of the machine is that the oily materials are heated by steam, thus causing the oil to separate out, which, thrown outwards by the centrifugal action of the rotating basket in which the articles are enclosed, drains off into a receiver; the cloths and waste are then removed, washed, dried and again put into service.

A metal casing, supported on a cast-iron frame base contains the basket, closed by a lid cover. This basket is of double cylindrical form; between the outer wall and the casing an annular space is left into which the oil is thrown through the perforations in this wall; the inner wall, also perforated is supported by the upper end of a vertical spindle, resting in a footstep bearing, bushed, and free to revolve the whole being rotated by means of a steam jet which impinges on turbine blades fitted into the base of the basket. The steam passes through the blades into the conical space surrounded by the inner wall of the basket, whence it exhausts through the perforations and mixes with the material inside. By this means the viscosity of the saturating grease is lowered and the thin oil, mixed with condensed steam is whirled through the outer wall into the annular space surrounding it, and led away to a filter and cooling tank, the cloths being removed when the oil has ceased to flow.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Australian Mail Contract.

MOST of my readers will be aware of the fact that one of the fortnightly contracts for the carriage of the mails between this country and Australia has been renewed. That was the one between His Majesty's British Postmaster-General and the P. & O. Company. The other contract at present running is that between the combined Orient Line and Royal Mail Steam Packet Company on the one hand, and the Commonwealth authorities on the other. It was this contract which was given a while back to the Armstrong-Laing-Beardmore Syndicate and their agents Messrs. Harris and Dixon. That arrangement, of course, proved abortive and the contract was reopened for fresh tenders. A new contract in its place, again with the Orient Company was signed on the 15th November. It is for ten years from the 1st February, 1910, the existing arrangements with that Company being continued to prevent there being any break in the continuity of the service. The contractors will take a slight increase in their subsidy, the annual amount payable to them being increased to £170,000. But they take very serious obligations. A minimum rate of freight for butter and fruit is fixed. They agree to fly the Commonwealth flag which, I take it, means that they undertake to be bound by any fantastic legislation which the Australian Parliament may think fit to pass. Further, it is expressly declared that they must withdraw from any combination which under the laws of the Commonwealth is declared to be illegal. They must not discriminate against trade unionists and they must employ nothing but white labour. They are to accelerate their service so as to reduce the time of the voyage between Brindisi and Adelaide to 638 hours. And above all things they are to build a new fleet. The ships are to be of 11,000 tons with a minimum speed of 17 knots and a refrigerating space of 2000 tons. Five such vessels must be ready to take up the work of mail carrying when the new contract comes in force. Eighteen months later another similar vessel must follow to take up the running instead of one of the vessels at present in use, which apparently will be allowed to work for a time, and by 1916 a second replacement of this kind will have to be made. As eight steamships are needed to maintain such a service it would appear that the *Ophir*, built in 1891, the *Orontes*, built in 1898, and the *Omrah*, built in 1902, will, at least for a time, be accepted for the mail service, though the former is of just under 7000 tons and the last named is only just over 9000 tons. But perhaps the most extraordinary thing connected with this business is the position of the Royal Mail Company. But a little while ago it will be remembered that, seeking new spheres for its activity, this company purchased from the Pacific Steam Navigation Company its share in the Orient Liner's partnership and took over from the Pacific Company the vessels which were used by it on the Australian service. What the exact consideration for this purchase may have been has not been allowed to transpire publicly. But whatever it may have been, the managers of the Royal Mail Company have now announced in the public press that they have given notice to the Orient Company to terminate the arrangement with that company in the month of February, 1909 just a year before the new contract comes into force. This is an undoubted fact. But a somewhat cryptic paragraph has been circulated by the Royal Mail to the effect that they "offered in the event of the Commonwealth deciding to make separate contracts with the Orient Company and the Royal Mail for one-half of the service with each, to build a number of large new steamers and give the Commonwealth a four weekly expedited service." It would appear however, that the Commonwealth has not thought fit to split its contract in the way the Royal Mail expected it to do. Under these circumstances it may be doubtful whether the "A" class of mail steamer of which the Royal Mail people are justly proud will continue to ply in the Australian trade after the termination of the present agreement with the Orient Company.

The Royal Mail Company are, however, showing their interest in the Commonwealth and in the service by sending, in January, their last and finest steamer, the *Asturias*, for a voyage to the Australian Colonies. She will be the largest vessel seen on this service, the vessel is about [illegible] tons and splendidly equipped.

The Combine's Fleets.

There has been a certain amount of shuttling of the cards between the various constituents of the International Mercantile Marine Navigation Company. First of all the twin-screw liner *Gothic* of the White Star Company built by Messrs. Harland & Wolff in 1893, for many years a favourite in the Shaw Savill and Albion service to New Zealand, has been transferred to the Red Star Company and fitted with increased steerage accommodation to adapt her for that trade. Then the *Tampican*, a vessel of about 4500 tons gross register, some four years older than she, and like her built at Queen's Island, has been moved to the same management from the Leyland Line. The *Tampican*, which is a single-screw steamer, was formerly a cargo boat between Liverpool and New York under the name of *Runic*, she and her elder sister *Cufic* being in fact the pioneers of the White Star cargo service in the closing years of the eighties. With them go two sisters, the *Memphis* and the *Mobile*, both built in 1891 by Messrs. Palmer's, of Newcastle, for the old National Line of Liverpool. When under the National flag they were known as the *America* and *Europe* respectively. But of late they have been owned by the Atlantic Transport Company, who renamed them to bring them into line with the other steamers of the fleet where all vessels' names are of American origin and begin with the letter M.

The Red Star Line has had a misfortune with its steamer *Finland*, which, like the Hamburg-American liner *Deutschland* some time ago has proved the dangers of Dover as a port for mail steamers. Entering the harbour on her homeward run from New York she struck the southern end of the breakwater and crashed in her stem and forward plating. Thanks to good workmanship she was able to proceed after temporary repairs. But the impact must have been severe, as the breakwater, though composed of 40-ton blocks of concrete and thirty feet thick, was so damaged that there is a crack through which light can be seen right across it. Many of the large blocks were displaced from their positions and the injured part will have to be rebuilt.

The New Cunarders.

Though unable to see the *Mauretania* at sea, I had the pleasure of inspecting her at Liverpool whilst she was lying at her moorings in the Mersey prior to her departure on her maiden voyage to New York. It is hardly necessary to say much about her main points. These were thoroughly discussed in regard to the sister ship *Lusitania*, and it were more reasonable to dwell on the points of difference. As regards the machinery department there are some striking changes in detail. Thus the turbines have a few more rows of blades, which is calculated to give slightly higher efficiency. No shroud rings are fitted over the blade tips. The diameter of the propeller blades is six inches greater than that of those of her sister. There are two main condensers only in the Tyne-built ship instead of four as in the *Lusitania*, but these are of great size and are said to be capable of condensing a million pounds of steam per hour. Then the boilers are a trifle less in diameter, though they have more heating surface and more grate area.

But it is in the passenger accommodation that the greatest diversities of design are apparent. The main plan of the two ships is identical. It is only in detail that variations are observable. The white enamel here and there relieved with gold of the *Lusitania* is largely abandoned. In the main saloon carved oak panelling takes its place. In the long corridors on the B deck, there are, one might almost say, acres of handsome mahogany panelling on the walls and an arched ceiling. This is exceedingly effective and cannot fail to be admired. But one doubts whether, from the practical point of view, the white enamel of the *Lusitania*, which aids the lighting, may not be really the better. The walls of the main staircase are panelled with sycamore wood—a ribald person who accompanied me ventured to remark that, from the known steadiness of these ships "sick-no-more wood" would have been more in keeping! The stairs themselves are of solid logs of walnut. This seems a tremendous expense for little purpose when one remembers that all but the sides of the stairs will be carpeted. Then the grill which surrounds the lifts in the well of the staircase is made of aluminium rails, whereby it

is claimed that a saving of weight amounting to no less than twenty tons is effected over the wrought iron of the sister ship.

The design of the lounge is entirely different from that of the *Lusitania*, the decoration being French. No one will deny that the fireplace in the *Mauretania's* lounge is handsomer than that of the *Lusitania*. But it is open to doubt whether the wrought-iron and copper grill over the dome, though certainly more in keeping with the scheme of decoration chosen, is more taking than the exceedingly handsome stained glass in Messrs. John Brown & Co.'s ship. The first-class smoke-room again differs not only in decoration but in arrangement. The room at the fore end of the main apartment is thrown into the main body by the absence of the fireplace which is placed at quite the fore end of the whole space. There are also one or two remarkable tables of carved walnut wood in this room. On the whole it may be said that the general impression made on one's mind by a visit to the second ship is that endeavours have been made by lavish expenditure to outdo the decorations of the earlier ship, though it is more than probable that, in fact, the design of the decorations was settled without reference to what was being done at Clydebank. Take it as one will, they are two fine ships, and those who see one will find it hard to believe that anything different can be equally fine with that at which they are looking. That the *Mauretania* will uphold the credit of her builders in the Atlantic competition no one who has seen her and read the details of her trials can possibly doubt for an instant.

The "Kaiser Wilhelm der Grosse,"

of the Nord Deutchser Lloyd, on her last eastward voyage, was struck by a heavy sea which carried away her rudder and stern post. This was on the 25th October at 2.30 a.m., the vessel being then some 1700 miles west of Plymouth. Captain Polack determined to keep her on her course and to decline assistance, and both these resolves he maintained. No less than twenty-one steamers are reported to have offered to help him—a liner of her character makes a desirable prize for salvors. But she kept on and maintained an average of over 18 knots on the whole crossing. On one day after the accident she did as much as 416 miles, and never made less than 400 miles except on one day, when the total fell to 302 miles.

The master never left the bridge till he had the Scilly Isles abeam, though he admitted that the vessel steered remarkably well under her engines. One cannot avoid the remark that it would be after passing the Scilly Isles though, that, getting into the stream of traffic up and down the Channel, the anxieties of a relatively disabled vessel would be most pronounced.

Such an experience, though it must throw immense responsibility on the shipmaster, undoubtedly casts much physical labour and mental strain on the engine-room staff. I notice that the German Emperor, ever interested in what concerns his Mercantile Marine, lost no time in decorating Captain Polack. This distinction no one will grudge him—one only wishes something of the same thing might be done under the Red Ensign—but the part played by the *Kaiser Wilhelm's* engineers should not pass wholly unnoticed.

Submarine Fog Signals.

At last, and after a foolish and undignified display of obstinacy in connection with the appeal to them by the Zeeland Steamship Company a few months ago, the Corporation of Trinity House has installed submarine bell signals in its *Royal Sovereign* and *Tongue* lightships. The Thames can now, therefore, claim to have adopted an appliance for safety which the Mersey and many foreign ports have shown to be of a valuable and relatively cheap character.

The unlucky "Principesa Jolanda"

seems unlikely ever to be floated. The claims under her policies of insurance have now been settled the underwriters paying fifty per cent. of the total amount of the insurances. This sounds perhaps a good let off for them. But it was a fair sporting chance that, if they had fought the matter out they might have escaped any payment at all. For it might well be argued that, the ship having left the ways, the "launch" was complete and the risk insured against run off. Something like £80,000 of a total of some £240,000 seems to have been insured in the London market.

The P. & O. Company.

Good ships, like good wine, seem to improve as the years go by. By the P. & O. Company's s.s. *Caledonia*, built as long ago as the year 1894 by Messrs. Caird & Co., it has to be recorded that a new best performance has been achieved. This vessel reached the Hooghly on the 13th November, having made her voyage thither in eighteen days from Marseilles or twenty-four days twenty-one hours from London. This feat was performed in spite of delays, quite outside the control of the navigators or engineers of the vessel, in passing through the Suez Canal. On looking at my notes I find that this is not the first record to the credit of the *Caledonia*. She captured the Bombay record as long ago as the year 1895 and held it for some years.

The Egyptian Mail Steamship Company

is to despatch its first steamship, the *Heliopolis*, from the Clyde to Alexandria on the 25th November. It is not possible to give an account of the ship or of her performances in the current issue of these notes. But, all being well, I hope to make the voyage as far as Plymouth in her, and to give a description of this luxurious and fast vessel in the January journal.

The Financial Troubles

on the other side of the Atlantic have involved the affairs of Mr. Charles Morse, the gentleman who engineered the combine of the United States coasting lines into one great company, known as the Consolidated Steamship Lines Limited. This organization had a capitalization of some twelve millions sterling in stock and about the same amount of four per cent. collateral trust bonds. The property represented by these securities covers the fleets of all the more important local steamship lines. The troubles which have befallen the combine will not apparently break it up into its original constituents—that is always an unlikely thing. But it has put the direction of affairs into the hands of some of the men who built up the businesses upon which the trust was founded and has relegated Mr. Morse, for a time at least, to a subordinate position, if, indeed he continues to have any real connection with his creation.

The Performances of the New Cunarders.

The *Mauretania* has been received with a flourish of trumpets. The Tyne work, say some people, is better than that of Messrs. John Brown & Co. On that point I will not venture to express any opinion. No doubt there is a certain appearance of superiority in the second of the two sisters. For both sisters the guaranteed speed on the forty-eight hours' trial was 25 knots. The achievement of the *Lusitania* was 25·04 knots, whilst that of the *Mauretania* was 26·04 knots which is said by an engineering correspondent to amount to an excess of from 8000 to 10,000 h.p. But anyhow, the *Mauretania* has not succeeded in wresting the maiden record from her sister. This is said to be due to exceptionally heavy weather, and at all events it would seem to show that even yet the Atlantic is not conquered. On the other hand the new ship has won for herself the record for a day's steaming, having accomplished six knots more in a day's run to the westward than her sister has as yet achieved.

Meanwhile the *Lusitania* has been setting the record to be beaten in friendly competition a point or two higher by her last run to the eastward, which she accomplished in four days twenty-two hours and fifty minutes, her mean speed being 23·62 knots. Her daily runs were: to noon on the 17th November, 430 miles; to noon on the 18th, 540 miles; to noon on the 19th, 554 miles; to noon on the 20th, 555 miles; to noon on the 21st, 550 miles.

The Port of London.

Mr. Lloyd-George, who has made a brilliant reputation for himself as President of the Board of Trade in his statesman like work in conciliating the opposing interest in regard to the threatened railway strike is risking a great deal in putting forward his bill in regard to the Port of London, for it has hitherto proved an insuperable and yet pressing problem. The scheme as at present outlined seems to satisfy no one. The Dock Companies protest that they are unfairly treated by the intention to attack them with rate-aided competition. The wharfingers say that they seem likely to lose their rights. On the other hand, the allegation that the public might find itself made to buy certain docks and leave others still unbought does not seem a point against the scheme. This latter element might be a good one—for some of the docks on the Thames are so obsolete as not to be worth buying—they might be left to their fate.

RENNIE'S PATENT VALVES.

One would almost have supposed that the last thing in stop-valves for ordinary purposes had been said in the beginning of the 20th century, but that such is not the case is exemplified by the

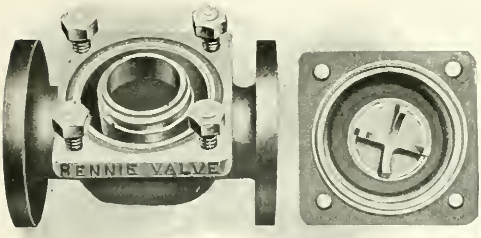


Fig 1

exhibition of the Rennie's Patent Valve, which we illustrate in the adjoining diagrams.

It will be noticed that Fig. 1 shows a $2\frac{1}{2}$-inch gun-metal valve with cover removed, while Fig. 2 shows it complete in sectional elevation. The outer body of the valve box and cover are substantially

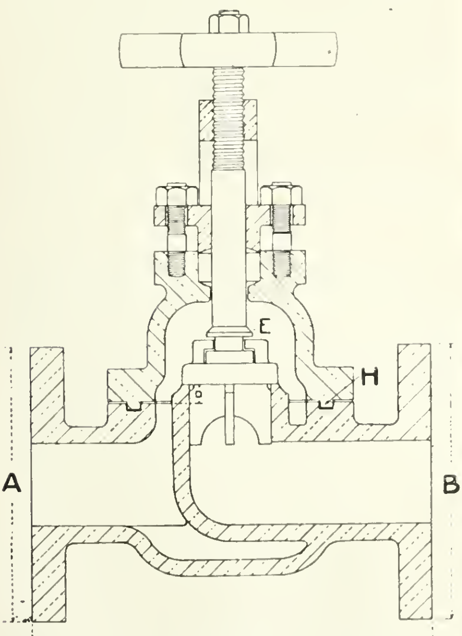


Fig. 2.

spherical in form, and there is an annular space between the inner and outer shell connecting the inlet and outlet branches A and B; this space is clearly seen in Fig. 3, which shows a section of a small gun-metal valve. The top of the inner shell forms the valve seat which projects above the point H, which is the joint of the cover with the body, the seat is thus quite open for examination and can be easily refaced and reground without removing the valve from the line of piping, and no reseating machine is required, an advantage which we feel sure no practical engineer will gainsay, and which will be of great advantage to marine engineers who have to deal with valves sometimes placed in very awkward positions.

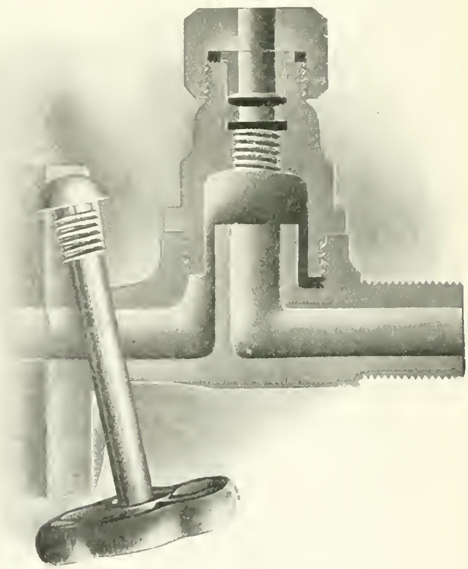


Fig 3

By reference to Fig. 2 it will be seen that a valve E is formed on the main valve spindle, which, when main valve is full open, closes against a seat formed on the bottom of the neck ring. By means of this valve the steam is cut off from getting through the neck ring into the stuffing box, which allows of the spindle being repacked with full head of steam on the pipe range. This is an advantage which none will disparage who have in their day packed steam glands when the steam could not be shut off.

It will be recognised that this construction of valve enables a needle valve to be fitted, so that the pressure on each side of the valve can be easily put into equilibrium, thereby enabling a valve of large area to

be opened without difficulty. The valve seat being a perfect cylinder inside and outside and of uniform thickness, the expansion should be more uniform than in a valve the seat of which is bound to the body all round.

These valves are manufactured by Messrs. Davie and Horne, of the Johnstone Engine Works, Johnstone, near Glasgow, who are the sole makers in the United Kingdom.

WOODESON'S PATENT WATER-TUBE BOILER.

We illustrate in the adjoining diagram a sectional view of the Woodeson's boiler fitted with chain-grate stokers. The advantages claimed in this type of boiler may be summarized as follows: All the heating tubes are perfectly straight, of the same length, and are arranged nearly vertically; there are no joints exposed to the heat of the furnace gases; all parts are free to expand; an unobstructed view of, and ready access to, each tube is obtained for inspection, cleaning and renewal; and a maximum steam-release area is provided with a minimum possibility of deposit in the tubes.

It will be noticed from the illustration that the boiler is made up of a number of sections, each consisting of a steam drum at top, water drum at bottom, and a number of groups of tubes expanded into flat discs on the steam and water drums. These flat discs are pressed by hydraulic pressure out of the solid plate.

Each steam drum is connected to its neighbouring steam drum by horizontal connecting or circulating tubes, and the water drums are also connected in a similar manner.

The whole boiler is hung suspended on girders, and is entirely free at the bottom to allow for any expansion.

On the top of the steam drums are arranged a series of man-holes, one immediately over each group of tubes, and any tube can be withdrawn and replaced through the man-hole above the particular group in which the tube is situated.

The feed water enters into the rear steam drum at the point farthest away from the fire, and the water flows down the tubes in the rear section and up the tubes in the front sections.

The advantage of this circulation is obvious, as the water enters the boiler at the coldest part and flows down the rear tubes in contact with the coldest gases, precipitating any mud or dirt into the bottom rear drum, and all the tubes in the front sections which are in contact with the greatest heat have practically clean water to deal with, therefore no deposit is found in any of the tubes exposed to great heat.

The firegrate is arranged across the boiler immediately in front of the front sections, and the gases travel upwards among the tubes of the front sections and over the firebrick baffle arranged between the sections and downwards among the tubes of the rear section and out at the back wall.

A large steam dome is arranged over the steam drums to ensure perfectly dry steam being obtained, while a super-heater is also added for the same purpose.

Large doors are arranged in the side wall of boiler for access into the bottom drums, and also into combustion spaces for inspection, etc.

Small sight-holes are also arranged in the walls for inserting a steam jet for clearing the tubes of soot.

These boilers are manufactured by the well-known firm of Messrs. Clarke, Chapman & Co., Ltd., of Victoria Works, Gateshead-on-Tyne, who are making a speciality of them.

Clyde Shipbuilder on Pneumatic Tools.—Mr. John Ward, a partner of Messrs. William Denny & Brothers, Leven Shipyard, Dumbarton, and president of the Scottish Institution of Engineers and Shipbuilders, spoke recently on the labour problems of the shipbuilding industry at a social gathering in that town. He said that in the open market for new ships the most dreadful competition that had ever been seen had taken place within the last year or eighteen months, and was going on at the present moment. Shipbuilders openly acknowledged that so far from profit being an object, it had disappeared into the background, and that now they looked upon it as a necessity to keep their places going at any cost. And while this was so at home, Germany and America were rapidly pulling up on them, and had produced some fine work during the past year. In the latter country which he had visited, pneumatic tools for caulking, cutting and riveting were in general use, and the results of their adoption were the lessening of the heavy manual labour and substantial increases of the workmen's earnings, together with improved workmanship. On this side of the Atlantic they had had experience of the caulking and cutting tools, but, from some inexplicable reason, a dead-set had been made against them by the men for riveting. He was certain were they given an honest trial there would be a great advantage all round. Economy of production was the necessity of the day, and this could only be got by rapid output and good workmanship.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

THE laying down of our new battleship has been delayed, and it has been officially announced that she will be begun early in December. The extension of the slip by fifty feet is nearly finished and a large quantity of material is ready, so progress will be rapid as soon as a start is made. Work on the *Bellerophon* is proceeding quickly and steadily. It seems almost impossible that it is not yet a year since she was laid down. The alterations to the *Dreadnought* having been completed she is now undergoing further trials. She proceeded to Plymouth on November 9th, carrying out trials of her new and larger propellers on the way. Having concluded the first of the series of tests, she coaled at Plymouth and then proceeded to Bantry Bay to calibrate her guns, after which she went to Aranci Bay, Sardinia, for battle practice, and is to return here shortly after Christmas. She will then be fitted with a new set of apparatus for submarine signalling, the Admiralty having decided to fit about twenty vessels with the new system. We had a visit at the beginning of November from Mr. Marshall, the Director of Dockyards, who conferred with the Admiral Superintendent as to the programme of work for this and the next financial year, as well as the refits of the cruisers *Terrible* and *Spartiate*. The battleship *Britannia*, of the Channel Fleet, is undergoing a refit, and while she is in dockyard hands arrangements are to be made for the cooling of her magazines. Orders have been issued for the battleship *Canopus* to be taken in hand at once and her repairs are to be completed by the end of March. All the destroyers in the Reserve Flotilla requiring repairs have been ordered to be taken in hand without delay, and all the available docks are therefore, occupied by those craft. The *Flirt*, which smashed her bows on returning to harbour after her recent refit, has been put right, and has gone to Harwich to rejoin the permanent destroyer flotilla. The *Lightning*, which has had her boilers retubed at Sheerness, returned here on November 8th. The surveying vessel *Research* came in at the end of October for her winter refit; as usual she will be laid up for the winter in the basin and will resume her duties in March. The *Calliope*, an obsolete cruiser which had been lying at the Motherbank for some time, has been allocated to the Newcastle division of the Royal Naval Volunteer Reserve, and has been towed round to the Tyne by the special service vessel *Seahorse*. The *Calliope* won renown at Samoa about eighteen years ago. Captain (now Admiral) Kane, who commanded her, did not like the look of an approaching hurricane and put to sea for safety. Of seven German and American warships which remained at the anchorage six were wrecked with a great loss of life. It was described at the time as the greatest disaster since the introduction of steam. Another obsolete cruiser, the *Medea* has been brought in here for conversion into a coal hulk for destroyers. We have had two Royal arrivals this month—the King of Spain and the German Emperor, the former being brought in the *Renown* from Flushing. Captain Tyrwhitt, who commanded that vessel on the Prince of Wales' visit to India, died at the beginning of the month at sea while on a voyage for the benefit of his health. He was a most capable officer and only a fortnight before his death had been appointed an aide-de-camp to the King. The German Emperor and Empress arrived on November 11th in a thick fog. The skill of Mr. A. Barnett, the senior King's pilot, who went out and navigated the Imperial yacht *Hohenzollern* into harbour has been a matter of much commendation. The yacht was escorted by the cruisers *Scharnhorst* and *Konigsberg* and the torpedo boat *Sleipner*. Festivities were, of course arranged for both officers and men during the time that they remained here. In connection with the visit the Emperor conferred several decorations, Admiral Sir Day Bosenquet, the Commander-in-Chief, and his flag captain and flag commander, together with Vice-Admiral Robinson, the admiral superintendent, being among the honoured recipients On November 15th another admiral arrived to take the command of the local division of the Home Fleet in succession to Rear-Admiral Login, whose twelve months have expired—Rear-Admiral Farquhar, whose father is almost the oldest officer in the Navy. The gallant veteran, it is worthy of note, also has two sons who are captains—Captain R. B. Farquhar, the chief inspector of naval ordnance, and Captain S. St. J. Farquhar, who commands the cruiser *Doris*, in the Devonport Division of the Home Fleet. A fire occurred on the morning of November 12th, the joiners' shop being burnt out and the chart depôt damaged by water. The fire was got under in a couple of hours by the police and parties of seamen, the German cruiser also sending her men to assist. Engineer Rear-Admiral J. T. Corner, C.B., the manager of the engineering department, is now senior officer of his rank, consequent on the retirement of Engineer Rear-Admiral W. W. Chilcott and the promotion of Engineer Rear-Admiral H. J. Cram, C.B. Engineer Captain C. J. North, who has been on the staff of the rear-admiral commanding the Home Fleet at this port, has vacated that appointment on promotion to Engineer Rear-Admiral and has been succeeded by Engineer Captain G. Elbrow, from the *Euryalus*, in the Fourth Cruiser Squadron that officer being succeeded on the staff of Rear-Admiral Inglefield by Engineer Captain J. J. Stuart.

Sheerness Dockyard.

The battleships *Bulwark*, *Majestic* and *Victorious*, having been sent to Chatham to be refitted, will be temporarily relieved by the *Hannibal* and *Mars* from Devonport and the *Prince George* from Portsmouth. There will be other changes soon, for we are shortly to have two new battleships here, the *Agamemnon*, completing at Messrs. Beardmore's, and the *Lord Nelson*, completing at Palmer's. They are both to be commissioned for service in the Nore Division of the Home Fleet. The *Agamemnon* will take the place of the *London*, which goes to Chatham in a fortnight's time to be refitted, while the *Lord Nelson* relieves the *Magnificent*, which is to undergo a refit at the up-river yard early in the New Year. It would appear as if Sheerness is to be the destination of all new vessels for their maiden commission. The ocean-going torpedo boat destroyer *Mohawk* arrived on November 4th from Messrs. White, Cowes, and next day began her trials off the Maplin Sands. She has attained a speed of 34·25 knots, which undoubtedly makes her the fastest vessel in the world. Quite a number of mishaps occurred to the destroyers of the Permanent Flotilla during the exercises in the North Sea. Considering, however, the large number of vessels engaged, this is no more than the exigencies of active service must lead us to expect. The *Fawn* went ashore and had to remain at Invergordon, where the new repair ship *Cyclops* has gone to repair her temporarily, and afterwards bring her on here. The *Orwell* collided with the *Earnest*, and was docked at Leith for repairs, but the latter vessel being only slightly damaged came on to Sheerness. The *Exe* and *Ettrick* were also docked at Leith in consequence of some slight damage. The *Exe* is now having her boilers and machinery overhauled. The *Welland* returned from Queensferry, after the manœuvres, to have some defects in her steering gear put right, but this only took a few days. The destroyer *Violet*, which was nearly cut in two by a four-masted ship in July during night exercises in the North Sea, is almost ready to leave to rejoin the Home Fleet at Devonport. The *Mermaid* has completed her refit and left on November 9th to rejoin the Channel Fleet Flotilla at Portsmouth in readiness to welcome the German Emperor. The *Lightning*, of the Portsmouth Flotilla, which has had her boilers retubed, proceeded to that port on November 8th, and the *Seal* has gone to Chatham to complete her refit. There are, however, several destroyers in hand undergoing refits, among them being the *Panther* and the *Ness*. Torpedo boats Nos. 114 and 112 have completed their refits and rejoined the flotilla in Stangate Creek. A change has been made in the numbering of first-class torpedo boats, Nos. 25 to 79 having a cypher placed in front of the number thus—025 to 079. It has now been definitely decided that the Gunnery School is to be transferred to Chatham in July of next year. Captain Casement has happily recovered from his accident, and, having been on a fortnight's leave, has resumed his duties as Captain Superintendent.

Devonport Dockyard.

At the beginning of the month orders were received that in correspondence relating to the new battleship the name

Collingwood was not to be used, and it was, therefore, thought that the Admiralty had selected another name. A week later, however, authority was received for the name to be used, so presumably she will be called the *Collingwood*. I hear that the dockyard authorities have asked the Admiralty to delay the laying down until February 1st, and this date has been approved. By that time a large quantity of material will be ready. This postponement, like that of the Portsmouth ship, has, I hear, been connected with the Cammell-Laird business, but there seems to be no adequate reason for this assumption. In the meantime all possible progress is to be made with the completion of the *Téméraire* and the *Minotaur*. The former is making marvellous progress, her side armour being practically complete. On November 7th nine barbette plates, weighing about 110 tons, were lifted into position in an hour and three-quarters. This beats the performance at Portsmouth on the *Bellerophon* last month, when your correspondent reported that five armour plates weighing 90 or 100 tons were fixed in three hours and ten minutes. The cruiser *Minotaur* began her trials on November 4th with a mooring test. The first of the runs took place a few days later and was successful. On November 12th she completed her thirty hours' trial at one-fifth power and left two days later for a similar trial at four-fifths power, but her bearings became overheated and she had to return. On the 16th while at anchor an explosion took place in one of her bunkers, five men being injured. The vessel was afterwards taken into the Prince of Wales Basin, preparatory to being placed in No. 9 dock for readjustments of the machinery to be made. The under-water portion of the hull will be cleaned while she is in dock, it being thought that four months' marine growth may have affected her speed. The cruiser *Spartan*, tender to the torpedo school ship *Defiance*, has been fitted with a special installation of wireless, similar to that which has been tried on the *Furious* at Portsmouth. The cruiser *Cornwall*, which is being prepared for service as a training ship for cadets, is well in hand, and she is to leave for her first cruise about Christmas. The cruiser *Gibraltar*, too, is practically out of hand and is due to commence her after-repair trials on December 3rd. A peculiar discovery was made at the end of October, when it was found that the battleship *Cæsar* had lost one of her starboard propeller blades. The vessel has been undergoing a refit in the tidal basin at Keyham, and the discovery was made when she was being dry docked. The accident must have happened some months ago—probably when she was acting as temporary flagship of the Atlantic Fleet—as the bracket was covered with marine growth. The repair ship *Cyclops* arrived from Sunderland at the end of October and after taking in stores proceeded to Invergordon on November 10th. It was at first thought that the *Cyclops* would be attached to this port, but I understand she is to be attached to the Nore Division of the Home Fleet. The old hulk *Cambridge*, which, linked to the *Calcutta*, has been the gunnery school for so many years, has now disappeared from her moorings in the Hamoaze, the school having been transferred to the Royal Naval Barracks. The two ships have been taken into the Prince of Wales' Basin at the North Yard, but it is not definitely known what is to become of them. The *Cambridge*, which is one of the last wooden line-of-battle ships built, was launched in 1858. The flagship *Impregnable* takes her place as saluting ship. A slight collision occurred on October 26th between the destroyers *Starfish* and *Daring* in the harbour. The former had her bow bent and the latter sustained a somewhat large dent on her port side, but neither vessel took in any water. They were in dockyard hands about a fortnight. Among the cranes which Messrs. Cowans, Sheldon & Company, of Carlisle, are to supply for the new dock is a 160-ton electric revolving cantilever crane, designed to lift that weight at a maximum radius of 95 feet. No. 5 Dock—the submarine dock, as it is now called—has at present in it five submarines for examination and refit. It is anticipated that the dock will be roofed in, so as to ensure freedom from outside observation. A report has been going the rounds that when Admiral Sir Lewis Beaumont, the Commander-in-Chief, leaves the port in March he will be succeeded by Vice-Admiral Sir Atkinson Willes. The name of Admiral Sir James Bruce has also been mentioned. I am told, however, on good authority, that the new Commander-in-Chief will be Admiral Sir Arthur Moore, who is now in command of the China Squadron. The officer to come here in January to command the Home Fleet is Rear-Admiral Denison. In connection with the raising of torpedo boat No. 99, which is now under repair, it is pleasing to note that the Admiralty have recognised the services of Commander Gilpin-Brown, who was in charge of the operations, by promoting him and dating his captain's commission the day that the vessel was raised—September 18th. Another appointment in connection with this successful operation is that of Lieutenant Damant to be Inspector of Diving. Two interesting promotions have taken place among the engineer officers at the port. Engineer Captain R. B. Priston, on the staff of the admiral commanding the Home Fleet, having been advanced to Engineer Rear-Admiral and Engineer Commander J. J. Frost having become an Engineer Captain. The officer who goes on the staff of the Home Fleet is Engineer Captain W. Sharp.

Chatham Dockyard.

The armoured cruiser *Shannon* is now undergoing her trials. She left on November 21st, and is to return about the middle of December, so that it is quite possible that she will be ready for commissioning by the New Year—that will be three years from the date of laying down. Now the *Shannon* has gone the only new work we have in hand is the two tugs and the submarines. This is a great change from former times, when as many as four large ships have been in hand at the same time. Still we have a good deal of refitting. Indeed, the Admiral Superintendent, responding to the toast of the "Imperial Forces" at the Mayor's banquet on Nov. 13th, said he thought that the repair work was sufficient to last through this and next winter too. The battleships *Bulwark*, *Majestic*, *Africa* and *Victorious* are under refit. The two former vessels will be completed by the end of January, while the *Africa* is to be completed by December 11th. The *Victorious* will go back to Sheerness in the middle of December and return here in Febuary for a complete refit, which will take three months. Then the *London* is to come in December and the *Magnificent* in January, and their refits are expected to last three months. As to the cruisers, the *Warrior* has gone. The *Natal* and *Achilles* were to be taken in hand on November 25th, and will be here until the first week in January. After they return to Sheerness the *Cochrane* will come up and afterwards the *Leviathan*. The *Bulwark* met with a mishap on her return from the fleet exercises, she having touched on a sandbank and sustained some slight damage. Her captain and navigating commander were tried by court martial, the latter being reprimanded. The cruiser *Diadem* arrived from Portsmouth and was paid off on November 15th in readiness for her refit. The scout *Pathfinder*, of the Nore Home Fleet, came in on November 6th to be docked for an examination of her under-water fittings. The *Thames* has completed her refit and gone to Sheerness to resume her duties as seagoing depôt ship of the Nore Submarine Flotilla. With regard to small craft, the destroyer *Opossum* was paid off on November 6th and placed in dockyard hands to undergo a refit costing £6700. Her boilers are to be retubed and her hull and machinery overhauled and repaired. The torpedo gunboat *Jeda* came in for her annual refit on November 16th. The destroyer *Salmon* has completed her refit, during which she had her machinery overhauled and was fitted with new boilers, and the *Seal* has come up from Sheerness to complete her refit. The *Thorn* has been completed and proceeded to Sheerness on November 13th. The cruiser *Hawke*, which recently underwent a thorough overhaul, was commissioned on November 16th to convey a new crew to Singapore. The special service vessel *Hearty* had a mishap in the fog on November 11th. She left in the morning with a thousand bluejackets for Sheerness, and had to return, but the fog lifting she made another attempt. After nearly running down the Commander-in-Chief's yacht, the *Undine*, the *Hearty* collided with a barge, which sank, the crew fortunately being saved. She then ran aground at Commodore Hard, the sailors on board managing to get ashore by sliding down ropes on to the causeway. The granting of a knighthood to Mr. E. H. Lamb, the member for Rochester, has afforded much satisfaction here, for that gentleman has evinced great interest in naval and dockyard matters and has constantly pressed the claims of Chatham. Commander Rimington, the assistant King's harbour master, whose term would shortly have expired, has had his period of appointment

extended for three years from last June. Lieutenant G. Stapleton, who had been here since the beginning of the year, has left us to take up the post of superintendent of the Basses and Minicoy Lighthouses, Ceylon, in succession to Commander Channer, who has retired from the service of the Board of Trade. Lieutenant Stapleton came on the Supplementary List from the mercantile marine twelve years ago. Engineer Captain G. G. Goodwin, who has just been promoted to that rank and appointed Deputy Engineer-in-Chief to the Navy, was chief engineer at this yard not very long ago. When the present Director of Dockyards was appointed, Captain Goodwin was chosen as his assistant at the beginning of this year. He is a fortunate man, for he was twenty-second on the engineer commander's list.

Pembroke Dockyard.

Good progress is being made with the *Boadicea*, and it is confidently expected that she will be sufficiently advanced by the end of December to enable the boring operations for the propeller shaftings to be commenced early in the New Year. We are now looking forward to what we shall do when the *Defence* leaves for her trials in June next. It is, of course, expected that we shall be allocated a cruiser—an improved *Edgar*—in the new programme, but even so, she could not be laid off and commenced for about four months. So it appears as if the summer of 1908 is to be a dull one for us unless some small work comes in. A rumour has been in circulation that the Admiralty intend two vessels of the *Boadicea* class shall be laid down here next year instead of the one *Edgar*. I give the rumour for what it is worth, but it seems hardly likely that more *Boadiceas* will be ordered just yet, seeing that that vessel is a purely experimental one. Local opinion inclines to the construction of one large vessel instead of two smaller ones. It would be much better for the yard in every way. On the last day of October the first of the 7·5 inch gunhouses of the *Defence* was hoisted on board. The gunhouses are complete with gun carriage, mountings, etc., and weigh nearly seventy tons. The gun houses for the twin 9·2 inch guns are also ready; these weigh eighty-three tons without carriage and mountings. The order recently promulgated that no materials are to be ordered from contractors while there is a surplus at other yards does not appear to work well in practice, although perhaps in theory it is economical. For instance, a destroyer might put in here to effect repairs after a collision and we might possibly have to send to another yard for the particular kind of plates required. Indeed, such has been the case. This state of things would not do in war time, that is certain. It is a coincidence that the old cruiser *Aurora*, which was launched at Pembroke twenty years ago, should be brought back to Milford to be broken up. She was bought a few weeks ago by Mr. Paton, of Pontypool, and is to be broken up within a year. The vessel is now in dry dock at Milford, having the heavy fittings removed, after which she will be beached near Pill Point and the dissection completed.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

New Cable Steamer.

THAT cables are not by any means defunct in these days of wireless telegraphy is proved by the fact that we have to record the building of new vessels for cable laying. The most recent is a vessel called the *Guardian*, built by Messrs. Swan Hunter & Wigham Richardson for the Central and South American Cable Co., of New York. The vessel is of a total length of 293 ft., beam 36 ft., and depth to span deck of 24 ft. 9 in. The picking up and paying-out machine is on the main deck and is known as the double combined paying-out and picking-up machine. The engines are arranged on the starboard side of the machine and are of the double-cylinder high-pressure type, 8 in. cylinders and 8 in. stroke, each developing [illegible] B.H.P. with a pressure of 150 lbs. The gear is designed that either engine will work one or both machines in a forward or reverse direction. With the two engines in gear they will haul cable against a 25 tons strain at 1 knot per hour or 10 tons at 2½ knots. By reduction gear, each machine can be driven at a higher or lower rate of speed. The cable drums are 5 ft. 8 in. diameter and 1 ft. 8 in. wide. The braking arrangements have been closely attended to and consist of steel straps lined with elm blocks, a hand wheel and worm gear on a double-threaded screw being the method of operation. Both brakes can, too, be made to act on one drum if necessary, to give extra holding back power. The actuating gear is all operated from the spar deck. Auxiliary machinery has also been supplied by Messrs. Johnson and Phillips, in the shape of steam hauling gear for putting cable in the tanks, a steam sounding machine, and three of their improved dynamometers. All the accessories incidental to this class of work have been supplied by the same firm, the cable fleet of the world being said by this vessel to number nearly 60 vessels.

Variable Speed Gear.

Amongst the firms who make a speciality of speed reduction gear is Siemens Bros. Dynamo Works, in which a motor speed can be varied from 400 to 1400 by a rheostat with 26 steps, so that the face plate of a lathe can run from 4·5 to 58 revolutions per minute, giving 52 different speeds. The motor is fed with current at 500 volts and develops from 28 to 35 B.H.P. The machine is shunt-wound and fitted with commutating poles. In a six-hours' run the temperature did not rise 50°F. in the armature and 30°F. at the commutator and field coils, the machine running sparkless throughout the whole range of speed, as also at overloads.

Electric Wharf Cranes.

There is considerable question as to the relative merits of electricity and hydraulic power for the above purpose, but with a lifting capacity of two tons a writer has given from actual experience with a radius of 36 ft. the speed given being 75 ft. per minute. In another case of lifting capacity of one ton the speed is 200 ft. per minute, the jibs having a rake of 25 ft. The full height lifted is 78 ft. and slewing through a range of 180°. The question of cost is the one the users are said to rely on, the reason being that not working up to full power the motor driving is the more economical. The average load is only at the most 75% and as electrical consumption varies proportionately as the load while hydraulic power remains practically constant throughout, it will be seen the reason for the advantage on the side of electricity.

Electric Projection.

Messrs. Clarke, Chapman & Co. are amongst the makers of this class of apparatus. The method of control is an important feature in these machines, motors being used for the tilting and turning operations. By an independent controller the projector can be worked from a distant point and the projector can be operated by hand, the weight being taken on friction rollers. In the Suez Canal type of 16 in. and 20 in. mirrors 10,000 c.p. and 16,000 c.p. are given respectively. These lamps burn on 65 to 100 volt. circuits and take either 45 or 100 amps. according to the design.

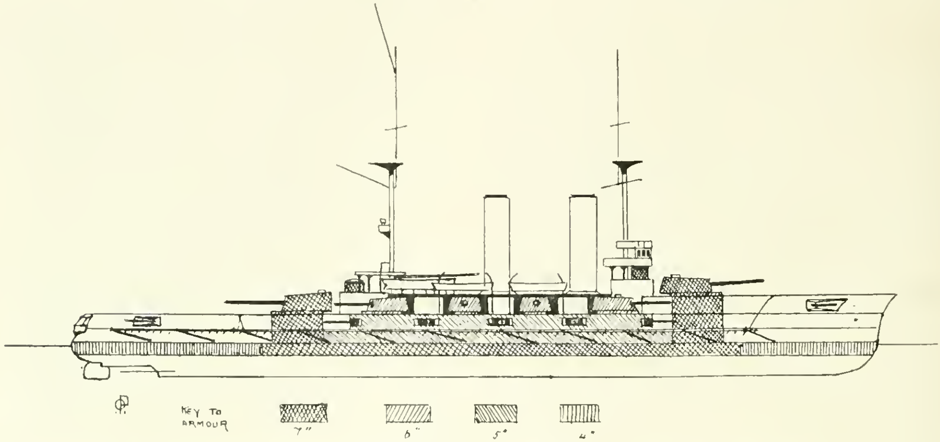
Wireless Telegraphy.

A new competitor in this field is the Amalgamated Radio Telegraphic Co., whose Irish station is nearing completion, from which they hope to shortly transmit messages across the Atlantic. It is the Poulsen system that we have previously called attention to that will be adopted, in which it is claimed that more power can be transmitted than is possible by the spark method. The masts employed are 360 ft. high and they carry 300 wires insulated at the upper ends. The transmitting apparatus is designed to transmit waves 3000 to 5000 metres long and the Company appears confident of being able to print messages. Fifty words a minute have been printed, but it is looked forward to attaining to 150 words. An instrument possessed by the Company has already recorded at 2060 miles distance.

The Central Marine Engine Works, West Hartlepool, inform us that the directors have with regret received the resignation, on account of long-continued ill-health, of Mr. Wm. C. Borrowman, who has been with them nearly nine years. They have now appointed as manager Mr. Maurice S. Gibb, who has been acting as assistant manager for some time. They have also appointed their chief draughtsman, Mr. J. B. Williams, as assistant manager.

IMPERIAL JAPANESE ARMOURED CRUISER "KURAMA."

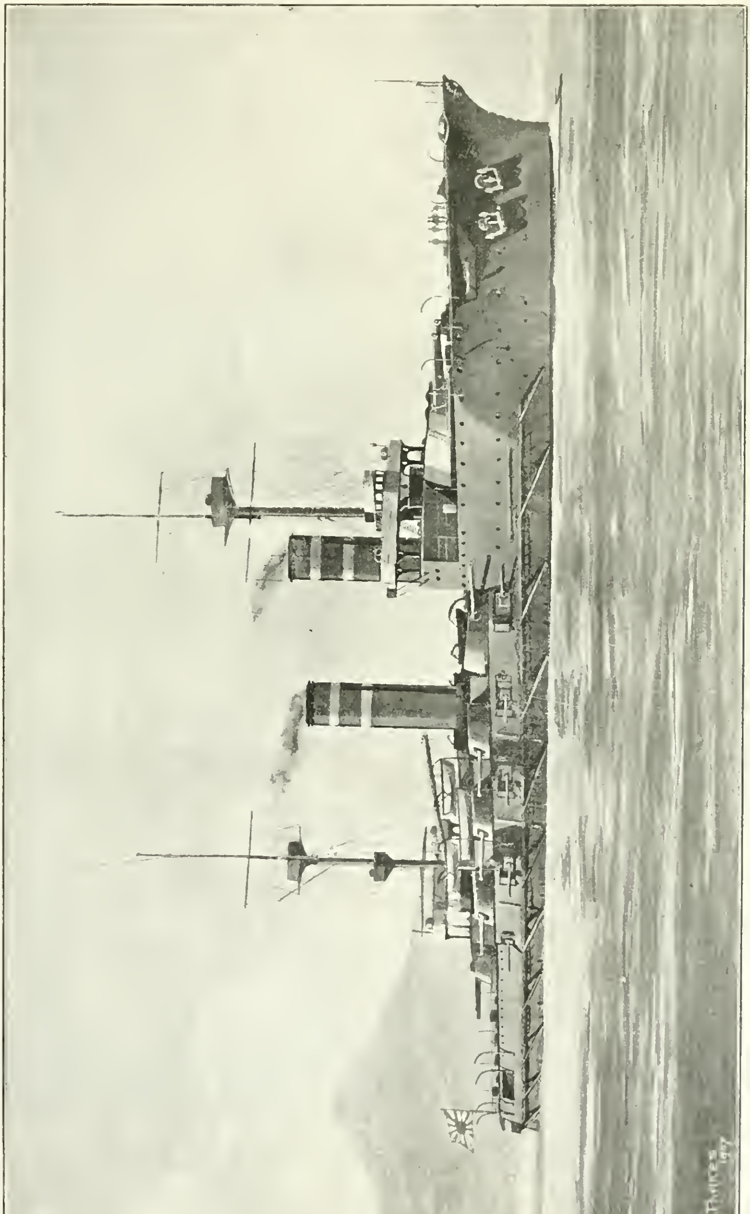
The "Kurama," launched on October 21st at Yokosuka, and her sister, the "Ibuki"—now under construction at Kure—will be, when completed, with the exception of our "Inflexibles," the most formidable cruisers afloat. In design they are the natural outcome of the "Tsukuba" class which preceded them, the increased displacement being necessitated by the heavier secondary battery and slightly increased speed. In fighting power the "Kurama" would prove a very hard nut for several types of our older battleships to crack; the "Majestic" and "Canopus" she completely outclasses, and the "Duncans" and "Queens" are barely her equal. Her speed of 21½ knots is too low for modern cruiser requirements, and hence although our "Black Princes" and "Minataurs" do not possess her gunpower, their higher speeds more than compensate for this as cruisers. The appended comparative table



COMPARATIVE TABLE.

Name	Kurama.	Tsukuba.	Minataur.	Inflexible.	Washington.	Quinet.
Nationality ...	Japanese	Japanese	British	British	U.S.A.	French
Date laid down	1906	1905	1905	1906	1903	1905
*Displacement	14,600 tons	13,750	14,600	17,250	14,500	14,000
Dimensions	450 × 75½ × 26 feet	440 × 75 × 26 feet	520 × 74½ × 28 feet	560 × 78½ × ? feet	502 × 73 × 26 feet	515 × 70½ × 27 feet
Armament ...	4 12 in.	4 12 in.	4 9·2 in.	8 12 in.	4 10 in.	
	8 8 in.	12 6 in.	10 7·5 in.		16 6 in.	14 7·6 in.
	14 4·7 in.	12 4·7 in.	16 3 pdr.	16 4 in.	23 14 pdr.	14 9 pdr.
Torpedo Tubes	4 below water 1 above „	4 1	5	3	4	2
Protection ...	Belt 7 in.—4 in.	7 in. 4 in.	6 in.—4 in.	7 in.	5 in.—3 in.	6¾ in.—3 in.
	Deck 2 in.	2 in.	1 in.	2 in.	3 in.	2½ in.
	Turretts 7 in.	7 in.	7 in.	?	9 in.—5 in.	6 in.
	Secondary do. 6 in.	5 in.	6 in.	?		
	Battery 5 in.	5 in.			5 in.	6 in.
	Lower deck 5 in. Side	5 in.	6 in.	?	5 in.	none
Machinery ...	Reciprocating	Reciprocating	Reciprocating	Turbine	Reciprocating	Reciprocating
Boilers	Miyabara	Miyabara	Yarrow	?	Niclausse	Guyot
I.H.P.	25,000	20,500	27,000	41,000	25,000	37,000
Speed	21·25 knots	20·5	23	25-27	22	23
Coal	600/2000 tons	600/2000	1000/2000	1000/2000	900/2000	1240/2300

* Normal.



New Japanese Armoured Cruiser "Kurama," launched at Yokosuka, October 21st, 1907.

makes a lengthy detailed description of her unnecessary; Japanese cruisers are built to "fight in the line," hence the protection is not unduly sacrificed for speed. With the exception of the two "Kasugas"—purchased from Argentine just before the war—all classes from the "Asama" onwards have a 7 in. belt, and this thickness is not likely to be increased in the gigantic "X" and "Y" now under construction; the sudden jump to a 25-knot speed with a greatly augmented battery will not allow much of the extra 4000 or so tons of displacement to be spread over protection. Both the "Kurama" and the "Ibuki" are to be completed in 1908, so that Japan is maintaining a high rate of shipbuilding. Our illustration shows her as she will appear at sea.

The Annual Report issued by the Committee of Lloyd's Register of British and Foreign Shipping contains information of considerable interest and value to all who watch the course of events bearing on the commercial life of the empire, and we are greatly indebted to the committee for the concise form in which the information is placed before us. Established seventy-three years ago, Lloyd's Register of shipping has moved with the times, full of consideration for those desirous of venturing into untried paths, whether in the form of hulls or in alterations of machinery and giving due regard to possible improvements while these have been but as specks upon the horizon—a wise course of policy—so that in the day of action their officers should be prepared to meet it. We have previously referred to the scholarships founded by the committee, and the remarks made by Mr. Jas. Dixon, the chairman of Lloyd's Register, at the dinner of the Institute of Marine Engineers, show the spirit and the will which animate the society in seeking to further the educational facilities of the country and aid its sons to take advantage of them. A Dixon scholarship for marine engineering under the ægis of the Institute of Marine Engineers would be a welcome addition to others of a similar character. To return to the pages of the report for the year ending June 30th, we find that 10,285 British and foreign vessels, with an aggregate tonnage of 19,724,728 were classed in the register book. Of these 789 new vessels were classed during the year, their tonnage being 1,484,722. The proportion of steamers among these is as 747 is to 42 of sailing ships, the tonnage comparison being as 1,470,312 is to 14,410. Of these new vessels 70 per cent. were bnilt for British owners and the remainder for colonial and foreign. The tonnage for the year is the largest on record. The increase has taken place both in steam and sail. The year which stands second for tonnage output is 1901-2, when it amounted to 1,425,416 tons; the succeeding years showed a diminishing output till 1904-5, when the rise was again upwards and continued. Naturally reference is made to the increasing number of steamers fitted with turbine machinery, and special reference to the *Lusitania* and *Mauretania*. The total tonnage of vessels so fitted and classed reached 88,865, while ten others with a tonnage aggregating 92,410 are in course of construction, or recently completed; it is interesting to note that two of these vessels are being built at Nagasaki of 13,500 tons each, a fact—which for those of us who knew this and other ports of Japan thirty years ago—cannot but cause us to draw the contrast between then and now. The two new turbine steamers *Heliopolis* and *Cairo* for the Egyptian Mail S.S. Co., each of 11,300 tons, are included. The conference between the British and German Governments relative to the load-line and free-board tables is made reference to and the desirability of a mutual understanding being arrived at is advocated. Since the report was prepared the conference has taken place with results which are anticipated to be of advantage to all concerned. A touching token of the esteem in which Sir John Glover, who retired from the chairmanship in June, 1907, is held, is given towards the close of the report, and we endorse the hope and wishes expressed that Sir John "may be spared for many years to enjoy the leisure afforded by his relief from the arduous duties of the chair."

SHIP REPAIRS AT LAS PALMAS.

We have had particulars sent us of repairs executed by the well-known firm of Blandy Bros. and Co. to the Norwegian barque *Agda*, formerly the New Zealand S.S. Co.'s *Waitangi*. This vessel, seen in the two views which we are

enabled to give, hauled up on the firm's patent slip, had been in collision, and the work executed included the removal and renewal of seven plates from bulwark down to turn of bilge, replacing of deck beams, frames and stringers. With the aid of pneumatic plant which was supplied by the Globe Pneumatic Engineering Co., Ltd., the job was completed in three weeks, the full weight of the vessel being given as 1150 tons. Considering the difficulties, the performance of such a piece of work is undoubtedly creditable. We have heard that Messrs. Blandy have since hauled up the S.S. *Manuel L. Villaverda*, 1500 tons gross register, putting a patch on one of her keel plates.

The photos give a very good idea of the location of the premises at Las Palmas, on which there are fifteen ton sheers, and five and three ton cranes. There is also a good general list of machine tools, enabling repairs of all classes to be carried out. For

instance, it is mentioned that 24 in. diameter shafts can be turned, and that ships of 350 tons can be built, also that castings can be made and finished up to one ton, enabling therefore all sizes of repairs to be undertaken. To those unacquainted with the port, this information may be of value. The firm's address in London is 16, Mark Lane, from whom further information can be obtained.

INSTITUTE OF MARINE ENGINEERS.

The seventeenth annual dinner of the Institute of Marine Engineers, of which we give a full-page view, was held on Wednesday, 30th October, in the King's Hall, Holborn Restaurant. The President of the Institute, James Knott, Esq., J.P., chairman of the Prince Line, Ltd., occupied the chair, and was supported by Sir Fortescue Flannery, Sir Wm. H. White, Sir Jas. L. Mackay, Sir John Gunn, Mr. Asplan Beldam and Mr. D. J. Dunlop, past presidents—Sir Walter J. Howell, Marine Department, Board of Trade, Sir Horace Tozer, Agent-General for Queensland, the Agents-General for New South Wales, Victoria, Tasmania and South Australia, Mr. William Watson, chairman of the Cunard Co., Mr. James Dixon, chairman of Lloyd's Register, Mr. T. Henry Riches, President of Institute of Mechanical Engineers, Mr. W. T. Hatch, President Association of Engineers-in-Charge, Mr. J. T. Milton, Chief Engineer Lloyd's Register, Alderman R. W James, Mayor of Bromley, Dr. Garnett, Mr. W. G. Kirkaldy, Mr. W. Allingham, Messrs. A. Boyle, R. Leslie, R. Elliott and M. C. Roberts, R.N.R., vice-presidents; Mr. E. W. Morris, Mr. A. G. Elliott and Mr. W. J. Lock, the executive office bearers and Council of the Institute.

Mr. William I. Taylor was convener of the arrangements.

After the loyal toasts, Sir John Gunn proposed "The Shipping Interests." He said there was a time when the British shipowners were looked upon as being carriers for the world. That was to a large extent true, for some thirty years ago we carried about 85 to 90 per cent. of the total commerce of the world. To-day the registered over-sea tonnage for the United Kingdom and the Colonies was 12,332,000 tons, Germany 2,434,000, France 1,350,000, Japan 1,128,000, and the United States 955,000. He was glad to say we were still the largest carriers. We now carried between 50 and 60 per cent. and, given honest fair play all round, the British shipowners would hold their own against all comers.

Mr. James Dixon, who replied, said he was sorry to say that the health of shipping, from the point of view of the freight market, had not improved during the week, but was rather worse. He had never known a rise of 10s. to 12s. a quarter on the Corn Exchange accompanied by such dulness in shipping. He attributed it to over-production on the part of shipowners. After alluding to the various ways in which the engineer ministered to the comfort and convenience of passengers on board modern vessels, Mr. Dixon said he thought that an institution like the Institute of Marine Engineers was a proper body for taking into consideration the advisability of establishing a scholarship in marine engineering in some University, and if the suggestion commended itself to the executive of the Institute he would be very glad to assist.

The toast of "The Institute of Marine Engineers" was proposed by Mr. J. T. Milton, who said that marine engineering was a very progressive profession, and the profession owed a great deal to institutions of this kind, composed mainly of engineers, who met together for their mutual education, for conferring and comparing notes of their experiences. The Institute welcomed not only those who had to deal with the main engines of ships, but also those engaged in the subsidiary, but very important, industries. Although young, the Institute was prosperous, and it would prosper more if all the marine engineers did their best to support the office-bearers and Council in furthering its interests. With the toast he coupled the name of the honorary secretary, Mr. James Adamson, the most indefatigable office-bearer that ever an institution had.

The Honorary Secretary, in responding, said: Mr. President, Mr. Milton and Gentlemen,—It is one of the annual pleasures of the executive of the Institute to listen to the plaudits evoked by the reception of this toast when the wine and the wit are flowing freely around the festive board, and on behalf of the office-bearers and Council I have to thank you for the renewed expressions of your appreciation to-night and for the repeated pleasure. I have also to thank you for your presence here to welcome our president amongst us at this semi-public function and to celebrate another anniversary in the history of the Institute, now in the last of its teens and about to enter upon a course which augurs well for its future success, the course of its third decade.

Our president, on the occasion of his visit to our premises to reopen the session at the beginning of the month, referred in his address to the operations of the Institute and the important bearing these have had upon the shipping industry, its progress and the work accomplished during the last nineteen years, to the increasing membership, to our good financial position, so that I need not enlarge upon these points; rather would I seek to enlist the help and enthusiasm of every member present in aiding the executive, to whom has been entrusted the duty of carrying on the work on behalf of the members.

Every member can assist in one way or another—there is ample scope as well for those through whose veins course the fires of youth as those on whose maturer judgment reliance may be placed to not only advocate the good but indicate the best. The arms of the Council can be sustained and supported greatly by the sympathetic help or advice of individual members, any plans or recommendations to improve the Institute in any of its channels of communication will be warmly welcomed and sat upon—with a view to bring forth improvements. It is essential to the progress and advancement of every undertaking of the nature of the Institute that the members should co-operate most heartily and enthusiastically, and the more hearty and enthusiastic the members are, by so much the more will the undertaking prosper. I seek, therefore, to bespeak and arouse that spirit which will adventure much in the direction of keeping the Institute of Marine Engineers in its progressive advancement. Are we proud of our occupation and the achievements which have added laurels to it, and not only to it but to our native land? The time passed within our generation has seen advances undreamed of in the days of our fathers in all branches of mechanics, and in no occupation more than in our own have these advances demanded more effort, more painstaking and more realization of responsibility. We know not what the future has yet to unfold, but this we do know, that it behoves us to study and to analyse more and more closely the materials we have to deal with in our daily life, not only the crude materials provided by the external world and shaped to the various ends of science, but we have to deal with the sentient material which has to be trained to think and to hold in subjection, within limits, the finished mechanism. The office-bearers and Council are alive to the importance of training the rising generation to think correctly and to act with judgment. By means of lectures, essays, papers and discussions, combined with healthful recreation, we seek to keep up the standard of thought and action, and any suggestion or recommendation for the good of the members—the marine engineers of the country—the Council will gladly welcome. A special room has been prepared in our premises and allotted to the junior section of the members upon the suggestion of one of our early members, whom I am glad to see here to-night, and I would most heartily urge upon the attention of every member present a consideration of the direct claims of the Institute upon him, and as we have handed down to us a legacy from those who have passed on before, so it is laid upon us to improve our heritage and hand it on to those yet to come, with not only undiminished lustre but added splendour. Let such be our aim, such our efforts, sinking individual ease and selfish airs in the desire for the uplifting of all those elements which go towards the advancement and improvement of the race and the standard by which man is judged, if not always by his own, by the generations which succeed him. As the humanity of the man is the criterion of his excellence, so let us keep this ideal ever before us and apply it to the work set before the Institute, so shall we go forward and aye bear with us those whose best interests we seek to advance, and in so doing we are assured we are advancing the hope of our country and the aspirations of those whose ventures float upon the face of the waters and cross the ocean to all lands. And now, ere I sit down, I should like to refer to the frank offer which has been placed before us to-night by the chairman of Lloyd's, Mr. James Dixon, and I am quite satisfied that the office-bearers and Council of this Institute will weigh wisely and well the words he has said, and I hope that they will bear fruit in after days to the good of the Institute of Marine Engineers.

Sir William White, in submitting the toast of "Our Guests," said they were all under a great obligation to Mr. Taylor and his colleagues who had arranged that very beautiful dinner. They had to-night a most representative gathering

of eminent men in many walks of life, and there was no section of their guests whom they were more glad to see than the representatives of the colonies, of whom there were so many present. He acknowledged on behalf of his fellow past presidents, how much they valued that annual invitation which brought them there as guests of the Institute. Among the members of the Institute of Marine Engineers there was a perfectly disinterested and unselfish feeling of regard for shipowners, and he was glad to couple with the toast the name of Mr. Wm. Watson, chairman of the Cunard Co., who succeeded a great number of men who had made history in steam navigation, and who was a worthy successor of the men who had gone before, when they thought of the vast undertaking which the patriotic Cunard Company had entered upon and which Mr. Watson had to supervise as head of that company.

Mr. William Watson, in responding, said that in speaking he was not accustomed to bring forward anything with regard to the Cunard Co., but it would perhaps be pretentious diffidence on his part if, after Sir William White's speech, he did not refer somewhat to the ships which had now made their advent. Those ships and the Cunard Company had loomed very large in the public eye during the last three or four months. They had been subjected to some criticism, not so much at home—indeed, he did not think any at home—but there had been a good deal of jeering as to their genesis from some of their foreign friends. They had been told that they were built up with British Government money, that they were paid a subsidy. He would like to state the real position. The two things hung together. A certain article was wanting—he had nothing to say about the desirability of wanting it—it was held that a certain thing was desirable, the question was, how was it to be done? The question of who was to find the money and how much was to be paid for it. The fact that the Government found the money was to save the country money. If they had borrowed the money on the Cunard Company's name alone and paid four per cent. for it, they should have demanded a greater annual subvention. Because the Government could raise the money cheaper they got what they wanted—he said nothing about the desirability—and they got it for a smaller subvention than if the Cunard Company had to raise the money. Again, he did not consider it a subsidy for erecting the ships and enabling a commercial undertaking to succeed. They were paid a certain sum for services rendered or to be rendered when called upon. After all, the Cunard Company had to face the bill in the end, and, be it success or be it failure, the risk was theirs.

Mr. David J. Dunlop proposed the health of "The President," and alluded to the long line of eminent men in the world of science whom Mr. Knott succeeded as president of the Institute. There were three kinds of great men; there was the man who was born great, the one who attained greatness, and the one who had greatness thrust upon him; and there was one peculiarity about the selection of presidents that the Council of the Institute had made, that not one of them was born great. Mr. Knott had attained greatness in his sphere. From a very small commencement he had risen to be the head of a line of "Princes," and they hoped that his services in that direction would be continued and that he would do his best to make the marine engineers more acknowledged by the world and more especially by their own shipping interests.

The President said he could not claim any direct connection with marine engineering except through the honour which had been conferred upon him in electing him as president of the Institute. The Institute was a striking demonstration of the strong, sturdy and individual character of the Britisher. They were not to look to the Government for assistance, but to institutes of this kind to help the young man of to-day. The United Kingdom was the nursery of the marine engine and was far and away ahead of all other nations in that respect. They, as shipowners, had been engaged all their lives in scrapping different types of engines and he was afraid they would have no rest—the energetic brains of marine engineers were still busy and were now directed to another type of engine, which they would probably be testing in the near future. This Institute had largely helped the British shipowner to maintain his supremacy of the sea, and, given a fair field and no favour, with the assistance of the marine engineer and the naval architect, they were going to maintain that supremacy.

THE FRANCO-BRITISH EXHIBITION.

THIS Exhibition, to be opened in May, 1908, at Shepherd's Bush, London, was on November 21st visited by representatives of the French and British press, who had the opportunity of seeing how rapidly the Exhibition was approaching completion. By the end of December, we understand the buildings will be completed and by the middle of January ready to receive exhibits.

The ground, containing some 140 acres, is all planned out, and many of the buildings have been erected. The visitors were conducted by way of the Royal Pavilion, Garden Club, the Palace Restaurant, the great Machinery Court, which will contain over 250,000 square feet of floor space, to the French section on the left hand and the British on the right, and the extensive gardens in the centre, and the Cloonial section to the Stadium, in which the quadrennial Olympic games are to be held.

The exhibits will be housed in twenty palaces. Between the main entrance and that in Wood Lane, there will be a series of eight spacious exhibition halls, each about 70 feet wide and about 400 feet long. The French exhibits, which it is expected will be more numerous than those displayed by France at any exhibition outside Paris, will occupy four of the halls mentioned above, and will be devoted to the liberal arts, science, social economy, hygiene, chemical industries and alimentation sections.

The Dominion of Canada, Australia, New Zealand and other British Colonies and Dependencies, will be represented on an important scale. The Canadian products and manufactures are to be displayed in a palace of unequalled magnificence. The Exhibition, which should prove of great attraction to the public, has been started under illustrious auspices, having received the approval of the King.

His Grace the Duke of Argyll, K.T., is honorary president, and the names of the gentlemen who are acting as chairmen of the different committees are sufficient guarantee that the Exhibition will be a financial success, and apart from the promotion of the *entente cordiale*, will afford an opportunity to the manufacturers of the two countries and their colonies of coming together in the advancement of commerce.

Institution of Engineers and Shipbuilders in Scotland.—The admirable address delivered by Mr. John Ward gives an excellent idea of the progressive advancement made in the industry which called into being the institution which Mr. Ward now presides over in succession to Mr. Jas. Gilchrist. It is a fitting and a happy coincidence that the celebration of the jubilee year of the Institution of Engineers and Shipbuilders in Scotland should also witness the attainment of another event in its history—the probable completion of the new building which was illustrated in our pages recently. It is further to be observed that the advent of the *Lusitania* and *Mauretania* is coincident with the jubilee year of this institution, the members of which have done so much to bring such vessels within the range of possibility and of accomplishment. Hitherto accommodation has been found in rented premises in Glasgow, which, notwithstanding, have become endeared to members by reason of the traditions and associations connected with them, and it was a pleasing feature in the new president's address to note the touching references to past members more recently called away, as well as to those whose names are now more memorable from the works they contributed to the present generation than from personal reminiscences of the men themselves; of these latter the name of the first president of the institution, Macquorn Rankine stands out prominently. Dealing with the early proposals and experiments made to drive ships by mechanical means, from those of Blasco de Garray in 1543 down to the days of Symington, Miller and Henry Bell and Fulton, the various names associated with steam navigation are given, with the dates of their patents, also a short description of the ideas covered by them—all most interesting matter. In 1736 Jonathan Hulls, of Berwick-on-Tweed, who obtained a patent for a method of towing ships into and out of harbour, against wind and tide, is claimed by one of his descendants, Mr. J. Hooper Hulls, to be one of the early inventors to whom is due a larger share of the credit of introducing steam navigation than is generally attributed to him. Mr. Ward in his address gives the particulars of the invention of Jonathan Hulls and the share he had in the introductory work, so that the recognition which is due to one who spent much time, labour and money in the initial stages of the introduction of steam navigation has been accorded.

Photo by Fradelle & Young, London.

Institute of Marine Engineers. Annual Dinner, at the Holborn Restaurant, on October 30th, 1907.

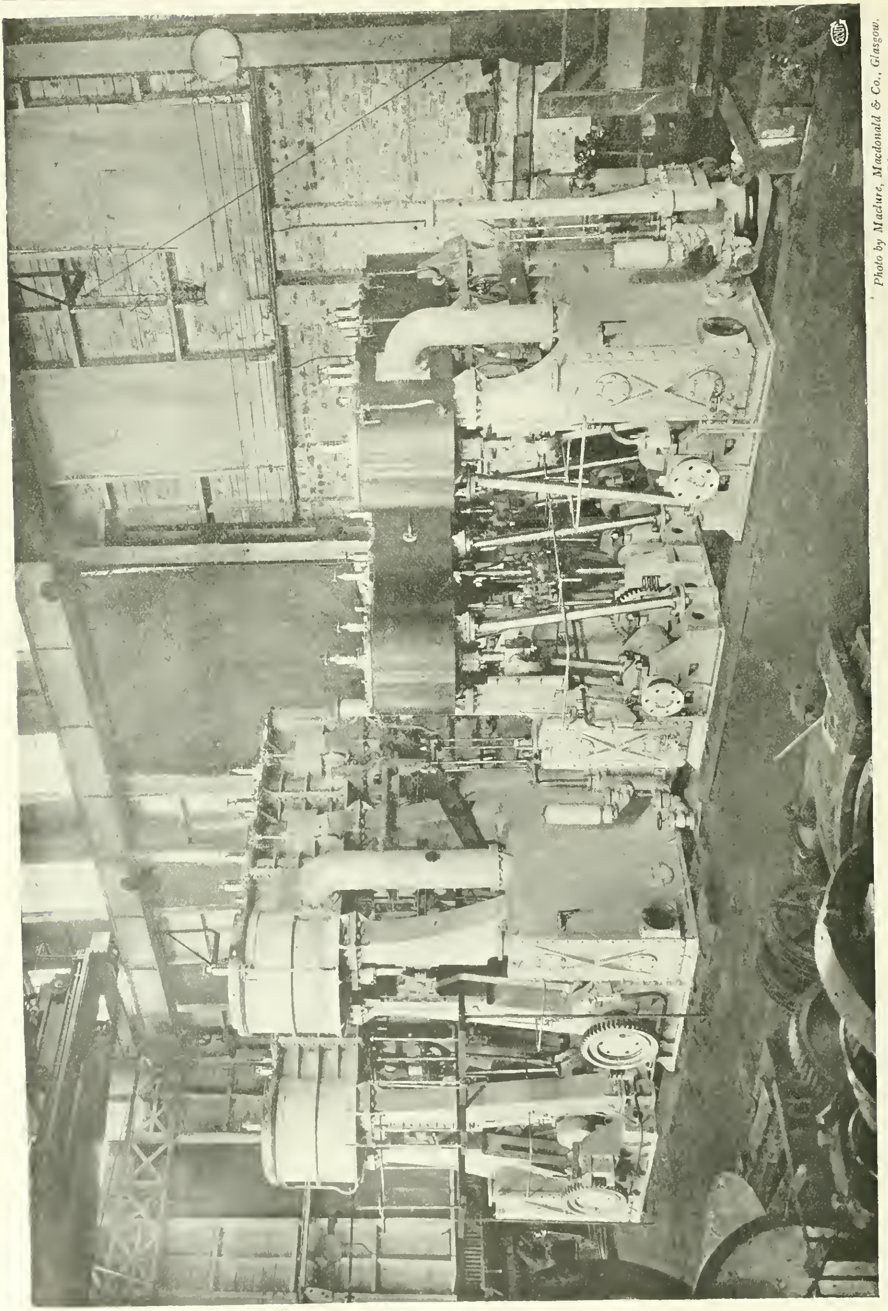


Photo by Maclure, Macdonald & Co., Glasgow.

Main Propelling and Pumping Engines, Sand-Pump Dredger "Lord Desborough," by Messrs. Ferguson Brothers, Port Glasgow.

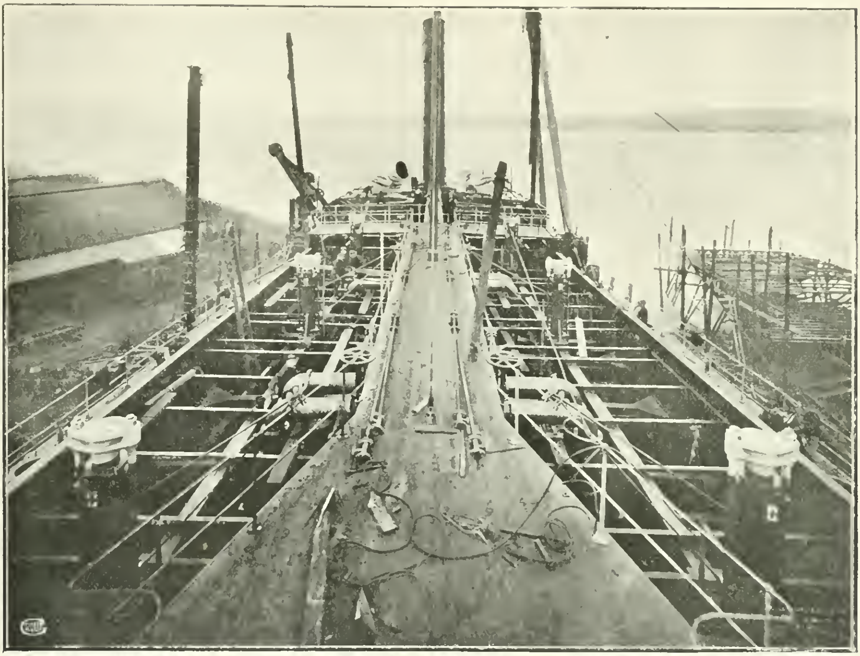


Photo by Maclure, Macdonald & Co., Glasgow.

Dredger "Lord Desborough"—View along the Gangway.

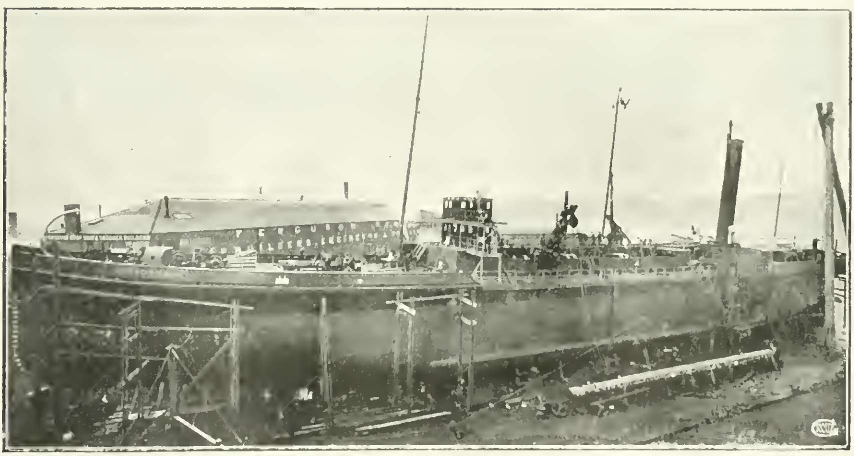


Photo by Maclure, Macdonald & Co., Glasgow.

Sand-Pump Dredger "Lord Desborough" on the stocks—Messrs. Ferguson Brothers, Port Glasgow.

POWERFUL SAND-PUMP DREDGER FOR THE THAMES.

FROM the stocks of Messrs. Ferguson Bros., dredger builders, Port Glasgow, there was launched on November 9th a very powerful sand-pump hopper dredger, the *Lord Desborough*, for the Thames Conservancy Board. The launch was witnessed by a large concourse of people, including Mr. Robert Philipson, the secretary of the Board, whose wife performed the naming ceremony. This vessel—illustrations of which on the builders' stocks and of her propelling and pumping engines in the shops we give—is the largest dredger, as regards dimensions purely, that has been built on the Clyde, and is also one of the largest of her class afloat. Her dimensions are 330 ft. by 54 ft. 6 in. by 23 ft. She is fitted with double-suction pipes arranged to ship inboard, and is capable of raising 4500 tons of sand per hour from a depth of 70 ft. below water level.

The *Lord Desborough*, named after the chairman of the Conservancy, has been built to work on the Leigh Middle Shoal in the Thames estuary, through which a channel will be formed 1000 ft. wide and 30 ft. deep at low water, this being part of the Conservators' scheme for providing a channel of that width and depth from the Nore to Gravesend. To obtain a channel of the dimensions named it is estimated that it will be necessary to remove at least 6,000,000 cubic yards of material from the shoal.

The navigating and pipe-manœuvring bridges of the *Lord Desborough* are placed forward of the hopper, and the chart-room and steering-house on the upper and lower bridges respectively. An accommodation gangway leads from lower bridge to engine casing. On this gangway—clearly shown in one of our illustrations—the gearing for working lander doors, wash-out valves and hopper valves is arranged. The accommodation for officers is arranged aft of machinery space. There is also a special suite of rooms for the superintending engineer. The crew's quarters are forward of the hopper.

The propelling and pumping engines, which are illustrated on page 180, have been constructed by the builders. The propelling engines are of the triple-expansion type, having cylinders 19 ins., 30 ins., and 39 ins. diameter by 30 ins. stroke. The cylinders of pumping engines are 12 ins., 20 ins. and 32 ins. diameter by 18 ins. stroke. Steam at a working pressure of 180 lbs. is supplied by three multi-tubular boilers each 15 ft. in diameter. The following items of machinery are installed on board:—Three sets of Weir's pumps, one Weir's evaporator and feed heater, four Gwynne's centrifugals, Kirkcaldy's distiller and pump, also separate duplex for water supply to sand pumps.

Electric light is fitted throughout. The telegraphs are by Chadburn, and consist of seven transmitters and six indicators. The pipe-manœuvring winches, of which there are two, one on each side of the vessel, are of massive design, each having four barrels and weighing about 20 tons. Above is an

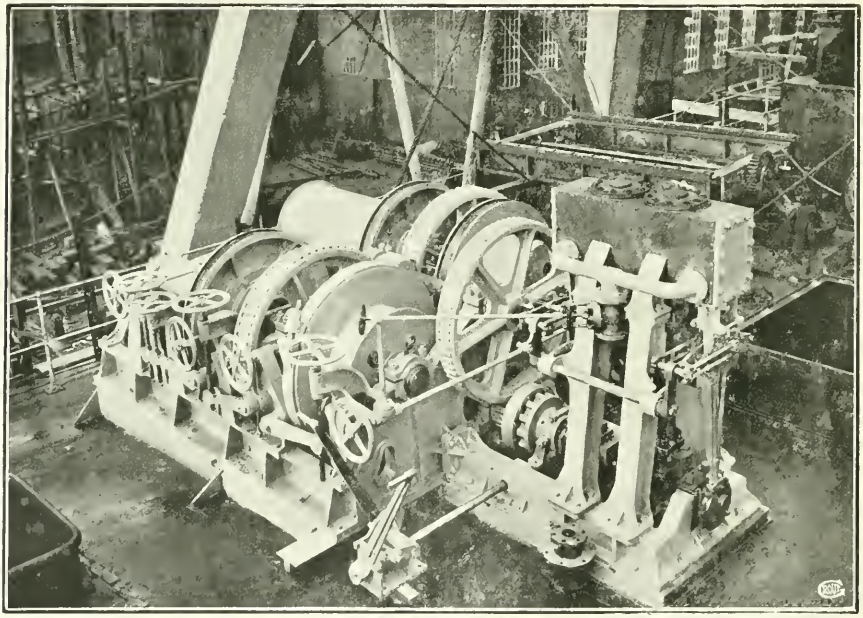


Photo by Maclure, Macdonald & Co., Glasgow.

Pipe Manœuvring Winch Dredger "Lord Desborough."

illustration of one of the winches in the building shops. The vessel has been constructed under the direction of A. G. Lyster, M. Inst. C.E., Engineer-in-Chief to the Mersey Docks and Harbour Board of Liverpool, assisted by Messrs. H. H. West & Son, naval architects, Liverpool.

It is worthy of note that Messrs. Ferguson Bros., who at present have on hand, with other work, a powerful bucket dredger for India, have constructed within the last three years the latest and largest dredgers for the three chief waterways in the kingdom, namely, the Mersey, the Clyde and the Thames.

ODDESSE PUMPS.

We have pleasure in giving our readers an illustrated description of a type of pump which has some special points of interest, and which is little known in this country. The object sought by the designers has been the construction of a duplex pump of great simplicity which would give a duty for steam consumers as good as an ordinary pumping engine with rotary motion. Another feature sought was to arrange the mechanism, so that at the highest speeds and pressures the valves worked quietly, and to avoid the use of valve gear having tappets, links, rock shafts and levers.

The point of particular interest in this pump, and in which it differs essentially from other direct-acting pumps, is the method employed for bringing the pistons to rest at the end of the stroke. As is known, the ordinary method is by allowing the piston to pass over the exhaust ports, thus cushioning the exhaust steam. This has, however, the great drawback that it is incapable of alteration for various speeds. Hence the chief cause of short stroking at slow speeds and knocking at high speeds.

Again, it is known to all users of direct-acting pumps that when they are run beyond very moderate speeds the compression causes a recoil of the reciprocating parts at the end of the stroke, and this naturally results in a hammering action of the pump valves.

Now in the Oddesse Pump the steam supply can be cut off at any point before the end of the stroke, and the fall of pressure due to the expansion of the steam brings the pistons quietly to rest, and a recoil is therefore impossible, even at the very highest speeds. Herein lies, therefore, the first and chief advantage of the Oddesse expansion gear. To this is, no doubt, due the fact that all Oddesse Pumps run so quietly, even at the highest speeds, and we understand that experience has shown the wear in the pump valves to be extraordinarily slight.

A second advantage following from the use of the Oddesse expansion gear is that the pump effects a considerable saving of steam. This saving varies with the class of pump and the speed at which it is run, but, it is claimed, usually amounts to about 25 or 30%. For example, in ballast pumps for large quantities of water and low heads the momentum is greater than in pumps for high heads and small quantities of water, such as feed pumps. But even at the slowest speeds, the expansion in an Oddesse Pump can always be so regulated as to ensure full strokes, and as in duplex pumps short strokes are the greatest cause of want of economy, a saving is effected even with the latest cut-off, as a result of the use of expansion valves.

Owing to the simplicity of the Oddesse valve motion, these expansion valves can be fitted very simply, and do not appreciably complicate the mechanism, or necessitate the addition of levers, glands or joint pins,

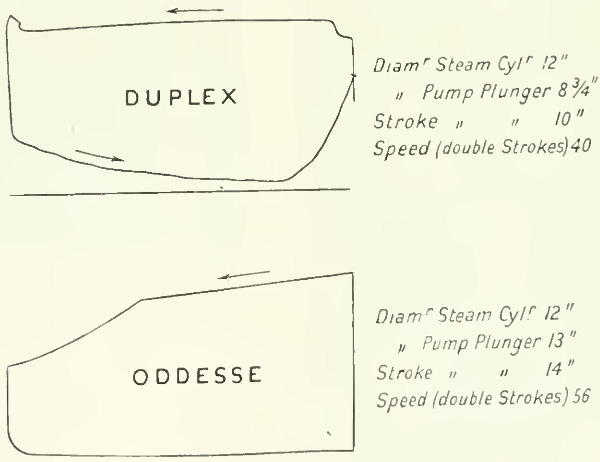


Fig. 1

so that the Oddesse gear with cut-off valves remains far simpler and more durable than the ordinary Duplex gear without them.

Figure 1 shows typical diagrams taken from Duplex and Oddesse Pumps. It will be observed in the Duplex Pump that the steam is piled up at the end of the stroke, owing to the main valve being open for a great part of the pause, and is exhausted at actually a higher pressure than during the stroke, which is, of course, ruinous to economy. It will also be observed that the exhaust is cushioned before the

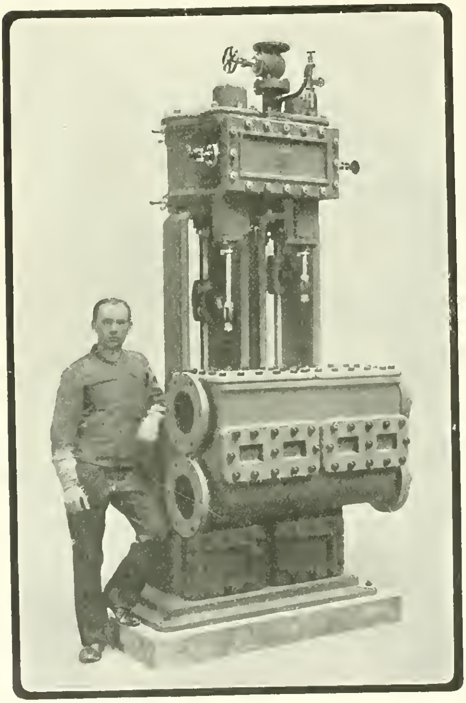


Fig. 2

end of the stroke; this is necessary in order to prevent the pistons striking the heads. At first sight it might be supposed that this cushioning would add to the economy, but a little closer investigation shows that this cushioned steam escapes during the pause and is therefore lost.

The Oddesse diagram is taken from a Ballast Pump running at 56 double strokes per minute. It will be observed that apart from the saving due to the expansion, the piling up of the steam has been avoided, and that the pistons have been brought to rest by means of the fall of pressure due to the supply of steam having been cut off. It will, therefore, be seen that even with our high-pressure pumps, where owing to the small momentum the amount of expansion obtainable is not so great as here shown, the saving of steam due to the cut-off valves is very considerable.

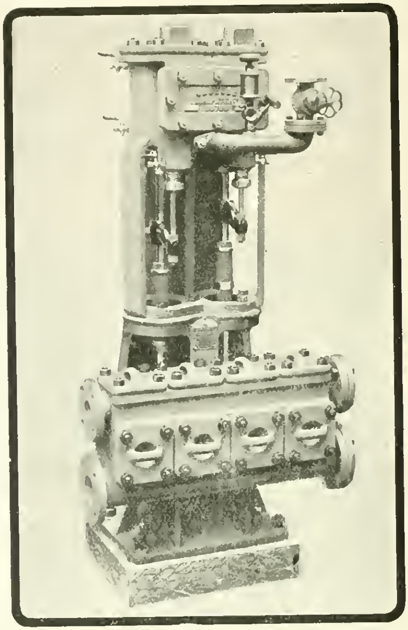


Fig. 3

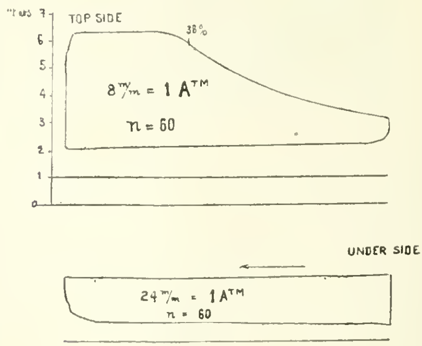


Fig. 4

Owing to this capability of running quietly at very high speeds, with the absence of all joint pins or wearing parts in the gear, the Oddesse Pump should form an ideal ballast pump. Fig. 2 shows a ballast pump having

a capacity of about 320 tons per hour. These pumps are being adopted as main feed pumps, as shown in Fig. 3 either in the Simple or Compound form. In the latter case the gear is practically the same, the variable cut-off however being applied to the high-pressure cylinder, whence the steam exhausts into a common receiver before being distributed to the low-pressure cylinders.

We understand that some excellent results are being obtained with regard to these Compound Pumps, which the diagrams, shown in figure 4, taken from a ballast pump supplied to the firm of F. Schichau, Elbing, seem to confirm.

These pumps are being introduced by the Oddesse Pump Company, 47, Victoria Street, Westminster, and we understand that although the pumps are at present little known in this country, there are already over 2000 successfully at work in other parts of the world.

PARAGRAPHS.

The Standard Marine Code.—The immediate object of a telegraphic code is to express in as few words as possible the details which one desires to transmit so as to save time and money. Bearing that in mind as a fundamental principle for all telegraphic codes, it goes without saying that any improvement introduced from time to time must increase its advantage to the possessor. The "Standard Marine Code," for the use of shipowners, shipbuilders, ship repairers, ship's officers, marine engineers, naval architects, etc., compiled by Mr. James Adamson, Hon. Secretary Institute of Marine Engineers, and about to be published in Volume 5 of *The British Engineering Standards Coded Lists*, is an endeavour to anticipate all possible exigencies and provide the shipowner with a reliable and complete mode of communication between the ship's staff and himself or his agent, when necessity arises. This code has been written by a practical man having full knowledge of all parts of a ship and thoroughly conversant with the working of same. The engineer should find in this book a phrase which will describe accurately almost every contingency that may arise and be able to express by a single word what he suggests might be done in the matter, and not only so, but upon consulting this book he might very likely discover there, quite unexpectedly, other phrases which would better describe the situation, or give him a choice of alternative actions, so rich is this code in suggestive material. It, in fact, furnishes to the sender, suggestions and ideas, which in the hurry and rush of thoughts induced by accident, must be most welcome, as enabling him to advise the owners of the mishap and allowing the latter to get ready replace parts against the arrival of the steamer at a given port, thus tending to economy and saving of time in repairs. We select two phrases, each of which can be expressed in a single word, by way of illustration, *viz.* :—"In all the work and details which are being undertaken for us, please note that the material must be good and reliable, and the workmanship of a first-class character in order that the capital expenditure may not carry with it a heavy interest in frequent repairs and renewal of details." "We do not believe in, nor do we in practice carry into effect the idea that cheap material or workmanship is good either for buyer or seller. It burdens the one and damages the reputation of the other." The companion volumes, already published, are very handsomely got up. No. 1, dealing with rolled sections of iron and steel tram rails, etc. No. 2, rails, pipe flanges, screw threads, Portland cement. No. 3, copper conductors, telegraph material, electrical machinery. No. 4, locomotives and railway rolling stock. We have no hesitation in recommending No. 5 to all those who are in any way connected with ships and shipping.

Among the changes which the generation of one age witnesses and contrasts with those of the previous generations there are many which are full of pathos and furnish food for the moralizer. It is not by any means one of the characteristics of the present age to moralize or to exercise the thinking faculties; the popular view as to the banishment of the ancient classics from the school curriculum is perhaps one of the evidences of this, and at the same time if fully carried into effect it will tend to perpetuate in the succeeding generation the growing proclivities of the present. The science of thinking, and thinking logically and correctly, is one which might with advantage be cultivated and encouraged among those who are rising to take the places of their fathers, and we hail the advent of this subject into the lecture-hall of the Institute of Marine Engineers. In the course of recent wanderings we were brought face to face with an inscription which reads as follows:—"Riches unemployed are of no use; but, made to circulate, they are productive of much good Increase of property is accompanied by a corresponding increase of care, wherefore, for their own comfort and that of their friends, George and Anna—Viscount and Viscountess Tarbat—have caused this small cottage to be built in the year of the Christian era 1685. Enter then, O guest, for this is the house of entertainment. Now it is ours, soon it will be another's; but whose afterwards we neither know nor care for none hath a certain dwelling; therefore, let us live *well* while we may." The date upon the stone which bears these words in Latin thus carries us back three hundred and twenty-two years. By the changes of time and custom, the building which was dedicated by the builders, to domestic bliss and friendly hospitality—where the wayfarer was welcomed as a guest, is now leased from the Duke of Buccleuch by the well-known firm of Messrs. A. B. Fleming & Co., Caroline Park, in which stands the most interesting building in which the Viscount and Viscountess received visitors under their hospitable roof, in terms of the inscription, has passed on since their days through the families of the Dukes of Argyle to that of Buccleuch, and whether the visitor is bent on pleasure or business a visit to the house and grounds now occupied in a very different way from that projected by the "Register Tarbat," over three centuries ago, will be found to well repay the time spent. Situated within easy distance of Edinburgh, towards Granton, above the banks of the Forth, the works of Messrs. Fleming afford not only healthful surroundings for their workpeople, but capital facilities for getting their goods to the various centres of distribution. The manufactures carried on by this firm appear at first sight to embrace a wide range of material, from printers' inks to lubricating oils, and especially to their solidified oil, which is largely used both in land and marine work for lubricating shafting. The variation in the materials produced may appear great, but there is one feature which is common to all, the uniform excellence of quality aimed at and obtained. The transition from printers' ink to oils is not so much out of the course of nature as it appears, in that the preparation of the former involved the use of oil, and in the course of treating the oil it was found that a good lubricant was obtained, and by experiments this was improved and placed on the market as solidified oil, the success of which brought about the more extended manufacture of other oils. The oils and pigments used for the inks and the material required for the mixing and refining of the lubricants are stored in large quantities within the grounds, so that the shades of the departed whose names and work were great in their day and generation may be supposed to flit to and fro amid storage tanks, cooperages and tinsmiths' shops, and the various sounds which arise from such, overlooked as they are from the walls of Roystoun Castle. Within the building now in occupation for the commercial and laboratory work of the firm are many evidences of the painstaking and talented workers of the days long gone by in the ceiling decorations, the carvings, the armorial bearings and the paintings. The laboratory of a manufactory where high-class printers' inks and lubricating oils are mixed, refined and tested, is a most important and integral part of the establishment and this is fully recognised here from the position held by the chemical director. New colour and grinding works have recently been started at Granton, while extensions have been made in Liverpool and Dundee.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Dearth of New Work.—The activity in launching and completing new ships on the Clyde, and the all but entire absence of new contracts of any importance, to which our notes during the past two months have testified, are matters which have been more and more accentuated as time has gone on. Even the launch of new vessels now comes at wide intervals, and vessels are sent off singly, and not in threes and fours by the same tide, as was the case some months ago; while the number of vessels afloat and fitting out in the harbours of Glasgow and Greenock, or alongside the builders' yards, is at a very low ebb. Very few orders were booked during October; the total reported amounting to not more than 20,000 tons, while as regards November, in so far as it has gone at the time of writing, the new work booked is not more than one-half that amount. Several of the large firms are almost idle so far as their shipyard departments are concerned. At Fairfield, Clydebank, and Dalmuir large numbers of men have been paid off and the yards are now working with very small staffs. Upper reach yards on the whole are worse off than those in the Port Glasgow and Greenock districts, some of the firms being absolutely without work. Even in the Port Glasgow and Greenock districts which have usually a fairly satisfactory number of cargo steamers on hand, complaints are rife of workmen being unable to find employment. In spite of this it may, in passing, be noted that a strike of carpenters and joiners has taken place at the yards of Messrs. Russell & Co. and Wm. Hamilton & Co., the main question at issue being whether one or two breaks for meals per day should obtain. This sectional strike has been under discussion by the Federated Employers, but all that has so far been done by the Federation has been to support the firms in question in urging the strikers to return to work, pending discussion and settlement of the dispute in a regular way. The only contracts of any moment reported as having been placed since November began are a screw steamer of about 6000 tons deadweight capacity to be built by Messrs. A. McMillan and Co., Dumbarton, for Mr. P. A. Gron, of Sandefjord, Norway; and three hopper barges ordered by the Government from Messrs. Fleming & Ferguson, Paisley, for harbour works in Nigeria; and a twin-screw tug, ordered by the Government from Messrs. Ferguson Brothers, Port Glasgow, for service on the West coast of Africa.

Depression in the Steel Industry.—Owing to depression in the iron and steel trade, numbers of workmen have been discharged from the Parkhead Forge and Steel Works of Messrs. William Beardmore & Co., Ltd., and on the 9th ult. the company shut down one of the plate-rolling mills, thus necessitating the dismissal of some 200 men from this section of the works. Other departments have from time to time been undergoing curtailment in the working staff, and altogether it is computed that 1000 men have been suspended. It was, indeed, rumoured in the district that the company had determined to close the whole of the works for a time, but this had no foundation in fact. The armour-plate department has been doing nothing for some considerable time, but a new contract from the Admiralty is shortly expected. The forge department, which has suffered a good deal in recent years from the active competition of German manufacturers, is happily fairly well supplied with orders. All over matters are expected to improve very shortly, but what would do more to restore briskness of trade would be a reduction in the price of fuel. When fully occupied Messrs. Beardmore's works at Parkhead, Dalmuir and Mossend are capable of giving employment to between 8000 and 10,000 workers.

Prospective New Work.—Although not by any means certain it is yet probable that Clyde yards will benefit to a goodly extent from the following future contracts known to be rapidly materializing. The Austrian Lloyd require two turbine steamers for their Egyptian service, and representatives of Clyde and other builders and engineers have been to Trieste on the subject. Another Austrian concern, the Hungarian Levant Line, of Buda-Pesth, requires three 15-knot steamers with reciprocating engines. The tenders for the three 10,000 tons deadweight steamers which the Lloyd Brazileiro recently took are still under consideration, and it is probable that the contracts will be fixed before the end of the year. Tenders will shortly be required for a new icebreaker for Canada, which is to be an exceptionally powerful vessel, with a speed in clear water of 15 or 16 knots. With the Australian mail contract fixed, the Orient Line is likely soon to require some notable additions to its fleet. The Fairfield Company built the Orient Company's last steamers (although the latest vessel of the combined fleet, the *Asturias*, was built by Messrs. Harland & Wolff), and there is a feeling even on the part of representatives of other shipbuilding firms who have been calling at the Orient Line offices that Fairfield may be commissioned to build the whole of the five new steamers required. With the working arrangement recently come to between Fairfield and the Cammell-Laird firm, whose magnificent new establishment at Tranmere Bay is available, there can be no doubt of the ability of Fairfield to be answerable for the whole five vessels in the time required. Messrs. Elder, Dempster & Co., of Liverpool, have still a steamer to place like those which were ordered recently from Messrs. Alexander Stephen and Sons, Linthouse, and Messrs. Harland & Wolff, Belfast.

Work at Dundee.—Unlike the condition of affairs at most of the shipbuilding centres the yards and workshops at Dundee are, on the whole, very well employed. The Dundee Shipbuilding Company have secured an order from a Continental firm for a cargo steamer of 1000 tons deadweight capacity. They have also on hand a vessel of 2000 tons for the Eastern trade and a number of smaller craft. The Caledon Company, in addition to a large Booth liner, which will not be completed until well on in 1908, have two large steamers for the British India Company; and Messrs. Gourlay Bros. & Co. are constructing several fast passenger vessels, two of which are to be fitted with the firm's speciality in triple-expansion three-screw forced-lubrication engines, such as the company fitted on board the *Londres* last year, and now doing good service in South American waters. This novel vessel was described and illustrated in our issue of December last.

King's Yacht.—The new royal yacht *Alexandra* is slowly approaching completion at the quay of the builders, Messrs. A. & J. Inglis, Pointhouse, and she is expected to be ready for trials about the end of the year. The machinery is all installed in place on board, and the turbines have had their first turning trials. The work still to be done is almost wholly concerned with the furnishing of the Royal and other apartments. The fitting-out of the vessel, like her construction, has been done in a leisurely manner, there being no ambition to break any records in the matter of fast workmanship, but rather to have everything as perfect as possible. The electric lighting installation is in the hands of Messrs. Claud Hamilton, Ltd., and will be on a very magnificent scale. In this connection it may be stated that the incandescent lamps on board will number considerably over a thousand, varying from 8 to 50 candle power, and will be of the Admiralty type as supplied by Messrs. Cryselco, Ltd., of Kempston, Bedford.

Turbine Steamers for Japan.—The *Hirafu Maru*, the first of two sister ships which will be the pioneer turbine steamers to engage in merchant service in Japanese waters, after having been put through very exhaustive trials by her builders, Messrs. William Denny & Bros., Dumbarton, is now on her way to the East while her sister ship the *Tarmura Maru* will shortly pass through her speed ordeals, and follow. With the contract deadweight of 250 tons on board, the *Hirafu Maru* was subjected to a series of tests, including full-speed trials on the mile and on a long course, also a six hours' coal consumption run of 18 knots, which was the full contract speed. The mean of eight runs on the mile was fully 19 knots, while the coal consumption was well below the guarantee. By arrangement with the Japanese authorities two spare sets of propellers were made, each having one variable feature as compared with the other and with the working propellers. Special progressive trials were run with these, and the results noted as regards speed,

economy and vibration. In this way some valuable and interesting records were obtained, and the corresponding service performances will be noted.

"**On the Mile.**"—During the first two weeks of November "the measured mile" at Skelmorie was to a greater extent than usual, requisitioned for putting notable vessels through their speed trials. Two high-speed turbine ocean liners, the Cunard *Mauretania* from Tyne stocks, and the new Egyptian Mail liner *Heliopolis* from Fairfield, were the most important, their trials of course, extending over larger areas. Other vessels put through their facings on the mile about this time—two on the same day sometimes—were the *Oceania*, built by A. Stephen & Sons, Linthouse, for the firm of Cosulich, Trieste—which firm has had many vessels built on the Clyde of late—the *Thomaso di Savoia*, built by Barclay, Curle & Co., Whiteinch, for the Lloyd Sabando Societa, Genoa, and the *Cape Finnisterre*, built by Russell and Co., Port Glasgow, all of them large vessels of good speed.

Gas Engine Propulsion.—The problem of introducing gas engines for ship propulsion—in which the Clyde firm of Beardmore & Co., along with firms elsewhere, have already taken share in solving—is likely soon to be considerably furthered by practical experiments which another Clyde firm are about to institute with a new gas engine, taking the motive power from an associated gas producer of the suction type, which works with bituminous as well as with anthracite fuel. This latter feature is, of course, a consideration which in itself gives promise of advancing the question of success from the practical standpoint very materially. Reversibility—another *sine qua non* in the application of new types of propulsive machinery on board ships—is also, it is believed, a feature of the plant in question. Details cannot as yet be published, but it may be stated that the engineer responsible for the design of gas engine and producer has long been associated, as designer with one of the best-known English firms of gas and oil engine makers.

Clyde Improvements. — The Glasgow Association of Students of the Institution of Civil Engineers is privileged this session to have as its president Mr. William Murray Alston, M.Inst. C.E., Engineer-in-Chief to the Clyde Navigation Trust, and at its first meeting held on the 11th November he delivered an opening address which, after dealing with subjects more particularly appertaining to local association affairs, treated exhaustively of the engineering schemes and methods by which the Clyde had been developed as a waterway, and the port of Glasgow made the prosperous and well-equipped port it now is. He pointed out that the chief factor in making the river what it is to-day was the consistent dredging carried on since 1824, when steam dredgers were introduced. The development of the harbour had kept apace with the river. The first quay was built in 1662, now the quayage is 25,002 lineal yards, and the water area is 204 acres. Dredging is being carried on, so as to give 23 ft. below low water at spring tides, or a depth of about 33 ft. at high water at Port Glasgow and 35 ft. at Glasgow.

New Engineering Works.—In several of the industrial districts of Lanarkshire, notwithstanding the depression which in many directions seems to have fallen upon the steel-making industry, new foundry and engineering works are at present being laid down. At Shettleston, what was formerly a chemical works is being extended and converted into a foundry for the production of Neil's patent rocking fire-bars, now very extensively adopted in boilers of large industrial works and in not a few sea-going steamers. At Sunnyside, near Wishaw a new engineering works for the construction of cranes of all kinds, to occupy about 4½ acres is being laid down by Mr. Alexander Jack, late of the crane-making firm of Marshall, Fleming & Jack, Motherwell. At Muirhouse, also in the Wishaw district, the new works of the Inshaw Seamless Iron and Steel Tubes Ltd., is practically complete, and manufacturing operations will very shortly be commenced with a full order for steam water and seamless gas tubes. The plant installed here embraces eight puddling furnaces, a rolling mill to produce about a thousand tons sectional bars per week, a 4½-ton steam hammer, a Pilger rolling mill with a capacity of 400 tubes per week, also numerous special machines required in tube manufacture. Steam for motive power and electric lighting is supplied from two large Lancashire boilers.

THE TYNE.

(*From our Own Correspondent.*)

New Developments at a Tyne Shipyard. — At the Low Walker yard of Messrs. Swan, Hunter & Wigham Richardson an important improvement is being carried out, which, when completed must tend to materially reduce the cost of constructive work. The improvement consists of a covering shed over one of the two new berths which were formed at the east side of the yard some two or three years ago. The shed is constructed of massive steel supports, and overhead girders, and is of similar design to that at the Company's Wallsend yard, in which the Cunard liner *Mauretania* was built. It is understood that it will be not less than 700 feet long, and of proportionate width and height so as to admit of the laying down of the very largest sized vessels. It is, we understand, contemplated to ultimately extend the erection so as to cover the adjoining berth, and also to equip it with electric hoisting apparatus to facilitate the work of building. When the project is fully carried out, the Company will then have at their disposal no less than six covered-in berths, in each of which vessels of the very largest class can be put down, and all of which will be equipped with the very latest and most effective hoisting gear. The Company will have an equal number of uncovered berths and for building capacity will be far ahead of all other shipbuilding firms in the world. It is good for the Tyne that a Company with such high ambitions should have made it the centre of their operations, and this, which has already been strikingly demonstrated, will be further shown as time goes on. The Company have now half a dozen vessels in progress, but there are still some berths vacant which it is hoped will soon be filled.

Messrs. Armstrong, Whitworth & Co.—This Company have just launched from their Elswick yard the battleship *Superb*, which is described as among the most powerful war vessels afloat, and they have still on the stocks a couple of vessels of almost equal importance. Their Low Walker yard is without doubt the busiest on the river, the whole six berths being occupied with vessels all of which are in early stages, excepting one that is being plated. It is also noteworthy that the frame bending department is still busy.

Messrs. Wood, Skinner & Co.—This firm continues to show evidences of briskness, a keel having just been laid in a berth recently vacated. There are also on the stocks two vessels well advanced in construction, and one (the s.s. *Elfrida*) at the quay being fitted out. Messrs. Dobson & Co. have three vessels on the stocks, one of which has only recently been laid down. The other two appear to have been ready for launching for some time. Messrs. Hawthorn, Leslie & Co. have just laid the keels for two large vessels and have another in frame. They have also two torpedo destroyers on the stocks and two in the graving dock being fitted out.

An Important Repair Contract. Messrs. Robt. Stephenson & Co. have in their graving dock a large two funnelled steamer to which extensive repairs are being done, and it is satisfactory to note that for many weeks past the unique accommodation of the dock has been constantly utilised. The firm have four vessels on the stocks one of which has just been laid down, whilst another is ready for launching. The remaining two are in intermediate stages, and there is a vessel in the water being fitted out The Northumberland Shipbuilding Company still keep busy if one may judge by appearances, as there are four vessels in early stages of building on the stocks, and one approaching completion. There are two vessels in hand at the Tyne Shipbuilding Company's yard and one at the quay receiving her final equipment. It is rumoured that the firm have another vessel to put down.

The Palmers' Company. It is to be regretted that this firm have at present as many vacant berths as there are occupied ones, which state of matters betokens hard times for Jarrow. The departure of the battleship *Lord Nelson* cannot now be very long delayed and the slackness will then be further intensified. There are two large vessels building in the electrically equipped berths, but the work on these is inadequate to keep employed the army of men who are really dependent on this establishment. It is rumoured that the

firm are in negotiation for further work, and it is to be hoped that their efforts to keep the yard going strongly will be successful. There appears to be little doing at Messrs. Readheads' yard at present, and there is but one vessel on the stocks, which has been ready to launch for some time. A report is current to the effect that some alterations of an important kind are contemplated. The yard has not been so slack for a number of years, and its continued inactivity is a serious loss to business people in the vicinity, not to speak of the working men, who are dependent on this old and hitherto prosperous concern for a living. The repairing shops at Tyne Dock and South Shields are at the moment pretty busy.

The Engineering Trade.—It has been intimated to the officials of the Amalgamated Engineers' Society and to other kindred bodies, that the employers will require wages to be reduced by the end of the year. The amount of the reduction asked for is 5 per cent. off piece prices and 2s. per week off time wages. A similar reduction is asked for from the members of the Boilermakers' Society working in boiler shops, and also from the fitters' labourers. The men affected are evincing opposition to the proposals, but it may be taken for granted that the reduction will take place, as it is but too obvious that the condition of trade makes it imperative that the cost of production must be lessened. The shipbuilding employers will also be demanding a wages reduction presently, as shipbuilding is in quite as bad a plight as engineering. Peaceable adjustment of these differences may, however, be looked forward to with certainty, as neither section is at this particular time in a position to offer uncompromising resistance to the employers' proposals. It is announced that the North - Eastern Railway Company contemplate erecting additional coal-loading staithes at a part of Jarrow Slake, which is to be dredged and made available, the object being to increase the facilities for dealing with the very largest class of vessels.

THE WEAR.

(From our Own Correspondent.)

The Shipbuilding Trade.—It has been reported that a Southwick yard which has been closed for some time was about to be re-opened, the firm having (it was stated) received an order. On enquiry, however, the report was found to be incorrect and the yard is still inoperative. The Sunderland Shipbuilding Company, however, have secured orders for two vessels, the construction of which will be commenced immediately. This work has come most opportunely, and will certainly lessen in some degree the distress now prevalent in the town. It is rumoured that another firm has booked orders, but so far this requires confirmation. Considerably more than half the number of building berths on the river are now empty, and it is feared that the number of vacant berths will soon be increased. The influx of repair work which is usually looked for at this time of year has not yet occurred ; but it is expected that one or two of the local graving docks will shortly be occupied with vessels requiring extensive overhauls. Prices of ship plates and other descriptions of materials have been reduced lately, and this, of course, is some relief to shipbuilders who had not bought largely ahead ; but relief in other directions is required before they can offer to shipowners the lower quotations which may have the effect of inducing speculation. Messrs. Pickersgill and Messrs. Priestman are reported to have booked some work. Notices for a wages reduction (2/- per week on time and 5% on piece prices) have been sent to the different trades connected with the Wear Conciliation Board. Bad trade is assigned as the reason for this action by the masters.

Engineering Work.—Slackness is still very manifest at the majority of engineering establishments, and foundries are without exception short of work. In the brass and copper works, business is also dull ; but electrical works still show signs of activity. Forges are having very little to do, and the local ironworks are now on short time. The motor department of Messrs. Lindsay & Carverhills' works is keeping very busy and a large staff of men is kept on. The firm recently despatched motor engines of special design to Demerara, the order having been executed in a remarkably short time.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

At the meeting of the Manchester Association of Engineers this month, Mr. Joseph Adamson asked the question, "Why is not Manchester as important a centre of progressive engineering to-day as it was in 1858 ?" He proceeded to answer the question himself by stating that it could not be a question of finance, as there was at the present time a much larger amount of money invested in the trade than was the case fifty years ago. The members of the Association, instead of devoting proper attention to new fields, had been diverting all their energies to reducing the cost of accepted articles, and what was originally engineering had deteriorated into mere manufacturing. The technical papers, he said, were full of trials of steam turbines, and Lancashire ought to be able to decide whether a turbine or a reciprocating engine was the more suitable for driving textile machinery.

The Radial Engine.—A new type of engine which promises to play an important part in steam machinery. The idea on the part of the inventor has been to obtain a direct leverage instead of a straight effort formed into a circular motion for shaft driving. It is shorter than the turbine, but greater in diameter. In place of the losses entailed by the thrust, the radial engine gives the full effect of the steam during the complete circle, instead of only during two-thirds. No cushioning of the pistons is necessary, and there is no direct pressure on them. The travel of the ordinary piston is a little over half its area—that by the new type is three times its area, consequently the expansion is so much greater. Its great advantage over the turbine engine is that it is reversible. Assuming that it can be utilised in place of the turbine for marine propulsion, the saving, not only in first cost, but of driving, will be phenomenal. The modern twin-screw turbine steamer has seven turbines. At no time can they all be at work, either the full speed, the cruising or the reversing engines must be idle. The radial engine can be used for all purposes, slow, full, ahead or astern.

Manchester Chamber of Commerce.—At the quarterly meeting of the Manchester Chamber of Commerce held during the month, Mr. E. H. Langdon, the president, pointed out that during the first ten months of the present year our exports had reached the enormous total of £357,600,000. The exports of cotton piece goods were 199,571,000 lbs., and 5,304,277,000 yards, as compared with 173,777,000 lbs. and 5,258,063,000 yards last year. Mr. Langdon also asserted that although wages had increased, no more money had been spent in provisions, which led him to the conclusion that the working classes were spending more money in dress, amusements and holidays. Employment continued good, and the working classes were prosperous. He was afraid, however, that an indifferent trade was in store for us, but if the threatened strikes in the hatting and spinning trades were obviated they would be able to tide over the difficulty.

The Ship Canal.—During the first ten months of the present year there has been an increase in the revenue of the Manchester Ship Canal of £25,507, as compared with the corresponding period a year ago, the respective amounts being for 1907, £422,823 ; 1906, £397,316. For the whole of last year the revenue showed an increase of about £49,000 on the previous year. A great deal of cotton has arrived at Manchester during the month just ended from America and Egypt.

Grain and Cotton Imports.—The grain imports to the port of Manchester during October were : wheat, 28,639 tons ; maize, 15,090 tons ; barley, 3,616 tons ; total 47,345 tons. The grain came from America, Russia, River Plate and the United States. So far the arrivals of cotton have exceeded the imports up to the corresponding date a year ago by thousands of bales, both of American and Egyptian cotton.

The British Coalite Co.—The British Coalite Co. recently applied to the Gas Committee of the Manchester Corporation for land in their occupation for the purpose of laying down a plant for the production of Coalite, but after consideration the Committee found themselves unable to comply with the request. The land applied for was in proximity to the Bradford Gas Works.

The Manchester Consular Association.—According to custom, the members of the Manchester Consular Association waited on the newly-elected Lord Mayor of Manchester (Mr. E. Holt) at the Town Hall on the 11th inst. and tendered their congratulations upon his appointment. His lordship, in reply, said it was his desire to do all in his power to further the interests of the Consular body in Manchester. The same body also paid a like visit to Alderman Frankenburg, the Mayor of Salford, who entertained the members of the Association to luncheon. Complimentary speeches were made, and Major Church Howe, the American Consul, said his country looked upon Manchester as the manufacturing centre of the world, and second to none as a city in any other country.

The Cunard Line and Canadian Trunk Railway.—During the month it was reported that arrangements had been made between the Cunard Line and the Canadian Grand Trunk Railway for a community of interests in the transit of passengers and goods between this country and Canada and *vice versa*. The arrangement, which has not been contradicted, not only embodies the running of steamers direct to Canadian ports from Liverpool by the Cunard Line, but also the provision of steamers by the Company to run between the Pacific Coast, Japan, China and Australia. So far as Manchester is concerned, the arrangement is looked upon as likely to afford increased facilities for the transportation of goods.

Lancashire Iron Trade.—The condition of the iron trade during the month has been one of steadily continuous depression. This applies to all brands of pig iron and hæmatites, and in a less extent to manufactured iron and steel. The only cause for this lowering of prices is attributable to the falling off in the foreign demand, for our home industries are in a satisfactory condition. There has been a similar lowering of prices in copper and tin, with occasional fluctuations, but on the whole the tendency has been downward. Prospects are not rosy of any return of higher prices at present.

Lancashire Coal Trade.—The coal trade is still enjoying a period of almost unexampled prosperity. The wages of miners have been increased in a remarkable manner during the year, and coal owners, naturally perhaps, have raised the prices of coal, thus recouping themselves for the extra wages bill they have been called upon to pay. There is no alteration to report in the average prices of the various qualities of coal at the pits, which remain according to our last list of quotations.

THAMES.

(*From our Own Correspondent.*)

The Thames and its Trade.—With the holiday season closed a leading question is to the front again as to what is to be done to improve London's port. We are told over and over again that it suffers by comparison with its competitors, that it is not up-to-date and is much behind the times, but it yet remains to be seen if we are nearer a solution of the difficulty. The activities of the members of the County Council are well known and those of the Rivers Committee have undertaken journeys at their own expense to various ports in England and abroad for the purpose of acquiring information on the subject. A formal report is not presented because of the promise of the Government to introduce a Bill next session, but it is understood to be the view of the majority of the Committee that the efforts of other ports are unrelaxing and that we on the Thames must do something if we are to hold our own, and they favour a new port authority, having powers and embracing all interests concerned. It seems to be agreed that the authority will absorb the interests of the Dock Companies, the value of whose interests has come to be recognised, but not only so, there are other bodies that will be included, among them the Thames Conservancy so far as its commercial side is concerned. There is not likely to be any municipalization of the docks, and it is probable that on the new body there will be a very strong commercial element and that the County Council will be in a minority altogether. The lines taken are likely to be after those ruling at Liverpool and payment will be by way o Port Stock. The reason the docks have proved their value is that in a strong tidal river like the Thames wharves have not the value some people try to make out, and that as a proof further docks are proposed already to meet the wants of the immediate future. That the new port authority will have control of all interests concerned is extremely probable, and its position will be one generally of commanding influence in every way and it is hoped then to settle the vexed question entirely.

The New Dock Schemes.—As mentioned above, proposals are in hand for new enterprises in this direction, and the location of the same is immediately above Tilbury. The proposers ask to be allowed to construct an entirely new channel across Swanscombe Marshes and the old circuitous section comprising 920 acres will then be closed and provided with jetties where big ships can be dealt with. This is the project. The sum of £5,000,000 is mentioned as the cost of this new dock at Grays and it will allow for the provision of no less than 98,000 linear feet of jetties available at all states of the tide. The dock area would be 50 per cent. more than that of all the present dock accommodation of London. Like Tilbury Docks, it is claimed there will be less charge for pilotage, less risks of navigation, fewer delays from fog and that the expensive dredging operations of the Thames Conservancy will be unnecessary. As to the distance from the centre, it is pointed out the railway facilities are there, and also that lighterage can be had on a single tide to and from London. There are to be entrances at each end of the enclosure by means of locks, which will be at least 1000 ft. in length and 130 ft. wide, with a depth of water of 40 ft. on the sills at low water springs. The jetties are to be from 1400 to 2000 ft. long and such that ships can lie on one side and barges on the other. Sites for modern graving docks have also been provided for in the scheme.

The Thames Conservancy.—This body meanwhile goes on with its dredging, and their Bill will be before Parliament next session giving them the necessary powers. In the interim they have borrowed £25,000 from the Bank of England to meet expenses till February next. The new dredger, named *Lord Desborough*, is 330 ft. long and capable of raising 4500 tons per hour. She is the largest ever built on the Clyde.

The Position of Marine Work on the Thames.—We had not long ago to chronicle the removal of Messrs. Yarrow & Co., and now the old-established firm of Humphreys & Tennant are said to have decided to close their works after the completion of the contract for supplying the *Invincible* with turbines and boilers. The position is sufficiently serious for London generally, but more particularly perhaps for the 1000 odd workmen who will thus be displaced. We need not go into the causes of this decision. The distance from the centres of production, the expenses of rates and high wages and the ever-increasing competition from every side all tell in the one direction.

New Issue of Shipping Capital.—The Royal Mail S.S. Co. have issued a prospectus for £700,000 4½ per cent. first debenture stock, the price being £98 per cent. The capital is part of £1,000,000 authorised, and is to redeem existing debentures and for the general purposes of the Company. The property on which the issue will constitute a first charge are the fleet of vessels, premises, plant and all the property of the Company, the profits after paying debenture interest having been in 1906 about £200,000. An interim dividend of 5 per cent. per annum has recently been paid on the preference stock of the Company.

The L.C.C. Steamboats.—Together with the publication of the receipts on these boats, which in the two weeks ending October 19th amounted to £143 and £100 respectively, we have the announcement that the boats are taken off entirely. It is too early yet to say what the ultimate outcome of the matter will be, but statements are already made public as to a possible discontinuance of the service.

Engineer-in-Chief of Navy.—We had recently to announce the retirement of Sir J. Durston from the position this gentleman has held so long, and now we have to note the promotion of his successor, Rear-Admiral H. J. Oram, C.B., who at the same time has been further advanced to the rank of Vice-Admiral in the Fleet.

Submarine Bells at the Thames Entrance.—The Trinity House has lately installed these bells on the Tongue lightship, by which a warning will be sounded in foggy weather to passing ships and it is expected other points will be similarly equipped, the utility of such apparatus being unquestioned.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow.—November has been an uneventful month in the shipbuilding trade of this district. No new orders for shipping tonnage have been booked, and the demand for new vessels is extremely quiet. In fact, the position in August last was one demanding a fair amount of new construction, but much of this was not placed because of the high cost of building material, and now when the cost has been considerably reduced the shipping trade has fallen away to a remarkable extent, and owners are no longer wanting new tonnage. There is always, however, a disposition on the part of owners to build new ships when prices are low. This business, however, is regulated by the knowledge of how far it is safe to anticipate a better state of things, and by the necessary wherewithal to pay for the ships when built. Firms, however, which have big reserve funds, and which also have resources from which to build new ships out of a depreciation fund which is added to year by year, are able to negotiate new business in quiet times, and, of course, in the end they profit largely by it, because in all probability before the time new vessels could be built and ready for service a brisker trade in shipping will have dawned. In the meantime the outlook is cheerless, and while the demand for new tonnage is quiet the competition for new orders is exceedingly keen, as practically all builders are short of work, and are ready to make great sacrifices in order to keep their men employed until a brisker market is experienced. Many builders are indeed on the verge of closing their yards altogether.

The Russian Cruiser "Rurik."—Vickers, Sons & Maxim are on the point of completing the Russian cruiser *Rurik*, and she is to sail from Barrow early next month for a Baltic port. Some 1500 men have been employed on her for some time past, and when the ship has been completed most of these men will be thrown out of employment, as in the meantime there are no new jobs coming forward to which their services could be transferred. The new cruiser will make a very worthy addition to the Russian fleet. She is unique in many senses, and in some of her details is well ahead of any ship built in recent years, either for the British or any other navy. Her fighting capacity is specially great, and her armour is more powerful than that yet put into any cruiser. She has a freer range with her guns than any British man-of-war, and her speed and general fitments compare favourably with any vessel afloat. It is expected that Russia, when she gets the *Rurik* into one of the Baltic ports, will copy the details of her construction in other vessels of a similar type which she proposes to build. There was some hope a short time ago that Russia would place the order for some of the battleships she requires with British firms, but it now seems to have been decided to build any further additions to her navy in Russian dockyards, and with that view both British firms and British capital are likely to come to the aid of Russia, and it seems certain that expert steel makers, gun manufacturers and shipbuilders will be imported from this country with the view of helping Russia in the patriotic desire to add new units to her fleet. Whether in the end this will be as satisfactory as the placing of orders with British shipbuilders at home remains to be seen.

The Brazilian Battleship.—Some idea may now be formed of the immense size of the Brazilian battleship building at Barrow. She is the largest vessel ever placed on the stocks at Barrow, and she has been carefully designed, and is being as carefully built. She will be launched about the spring of 1908 and by that time the dock-widening operations between the Ramsden and Buccleuch Docks will have been completed, and the new filling up wharf on the side of the Buccleuch Dock, with its gigantic 150 ton electric crane, will be ready for dealing with the largest class of vessels, whether warships or big ocean liners. The rumour got afloat some time ago that the Brazilian battleship building at Barrow and her sister ship building at Newcastle were really for the Russian Navy, but there is no shadow of evidence that this is so. The vessels are being inspected by Brazilian experts and officers, and the arrangements for her construction were made after much careful investigation and approval, and after advice taken from the highest and best sources based on the experience of the most recent naval warfare. There can be no doubt about it that these vessels are intended for Brazil, and when they are delivered, and even before they are delivered, they will awaken other South African Powers as to the unprotected position they will be in when Brazil can dictate terms with the twenty 12-in. guns which will be mounted, ten apiece, on the two *Dreadnoughts* now in course of construction. Indeed, coming events are casting their shadows before, for the South African Powers are now considering how they can place themselves in a position to deal with the new condition of things. Argentine has already ordered two large cruisers and other Powers are contemplating the addition of new battleships to the fleets they already possess.

L. & N. W. Steamers.—The first of the three steamers building at Barrow for the London and North-Western Railway Company's Holyhead and Dublin service, two cargo boats and a passenger steamer, was launched at Barrow during November. She was named *Slieve Bloom*, an interesting description of which will be found in our list of launches on another page. Another of these steamers, the *Slieve Galleon*, is to be launched in December and the third in the beginning of the year.

Mexican Transport Steamer.—The Mexican transport steamer building at Barrow will be launched before Christmas. She is only a small vessel, but she is expected to be the predecessor of a new Mexican Navy yet to be built.

A New Turbine Steamer.—Very great interest is centred in the new Isle of Man Steampacket Company's turbine steamer, which will be launched from Vickers' yard early in the New Year, and which is to be ready for her station next Whitsuntide. She is to beat the *Viking*, which has given a very good account of herself, and she is to carry 2500 passengers.

A Fleet Laid Up.—Seven of the largest steamers of the Isle of Man Steampacket Company are laid up in the docks at Barrow for the winter months. Here they undergo a complete overhaul for next season's traffic, and they furnish a good deal of work for Barrow.

Midland Railway Company's Steamers.—During last month the Midland Railway Company's steamers *Antrim* and *Donegal* have undergone repairs at Barrow in the graving dock, and previous to this the *Londonderry* was completely overhauled. The Isle of Man steamer *Manxman* is lying up for the winter months.

Engineering.—There is much activity in the engineering shops in this district, and this remark applies equally to gun mountings and marine work. Some further important orders for gun mountings have lately come to hand.

West Cumberland.—There is no variation to note in the steady trade doing at the Maryport and Workington shipyards. They seem to be busy in good and bad times alike, and their prospects of new work are reported to be satisfactory.

Shipbuilding Material.—There is a a quieter demand for shipbuilding material and prices are consequently easier. Heavy plates are at £7 5s. net cash, and boiler plates are at £8 5s. per ton. A fairly good business has been done during the past month or two in heavy castings for shipbuilding and engineering work.

Hæmatites.—There is a very quiet trade in hæmatite iron, and prices are much lower, makers quoting 69s. net f.o.b. and warrant sellers 68s. 4½d. net cash. Stocks are down at 6541 tons.

Shipping.—The shipping trade is quieter. The exports of iron and steel from west coast ports this year has reached 760,226 tons, being an increase of 30,000 tons on the corresponding period of last year.

HARTLEPOOLS.

(From our Own Correspondent.)

Docks.—The Chamber of Commerce have made representations to the North Eastern Railway Co. (the owners of the docks), relative to the inadequacy of the facilities at the docks for unloading timber-laden ships.

It is gratifying to note that the railway officials have lost no time in remedying the state of affairs as far as possible during the crush, and, no doubt, they will put forward a scheme before next season so as to be able to cope with ever increasing cargoes of timber coming into the port year after year.

The North-Eastern Railway Co.'s graving dock extension will be finished in a month or two's time, ready again to dry dock steamers of modern-day requirements. It was originally built for the long wooden craft therefore very narrow; all this has been altered and when finished it will become quite an asset to the port.

Shipbuilding.—Our shipbuilding yards are like the rest of the north-east coast yards and that is the berths are becoming vacant, without any prospect of laying down new keels, so the outlook is looking worse to-day than it has done for many years past.

Engineering. The Turbine Works have been very busy lately, but the shops are now finishing the greater part of their orders although they have booked several orders within the past few weeks.

The shops for the reciprocating engines etc., are still swinging away with the work they have in hand, but new orders for machinery are not coming forward with any degree of haste.

SOUTHAMPTON.

(From our Own Correspondent.)

The White Star Liner "Suevic." The new bow portion for this vessel, which has been built by Messrs. Harland & Wolff, of Belfast, arrived here safely on the 1st November last, after having encountered very stormy weather during the passage. Notwithstanding the severity of the weather it was quite tight on its arrival, and its strange appearance attracted crowds of people throughout the day. The vessel was drawing about 8 ft. aft and 27 ft. forward, and contained a large consignment of machinery for the extensive repairing shops which Messrs. Harland & Wolff are building near the Trafalgar Dry Dock. After discharging this machinery it was towed round to the Trafalgar Dock to be joined to the salved after-portion. The after-portion was ballasted with about sixteen feet of water to prevent any movement whilst the new bow portion was being floated into position. Four large baulks of timber, each about forty feet long by fourteen inches square, were secured to each side of the after-portion, so that about twenty feet of each projected so as to form guides for shipping the bow portion. When all was in readiness the dock gates were opened and the bow portion centred. Ropes were then fastened to it and led away to the steam winches on the after part, and the bow was thus drawn up into position. Stretching screws were then made fast to each side to prevent any subsequent movement, and the water pumped out of the dock, these operations being eagerly watched by large crowds of interested spectators. In order to enable the bow portion to be towed round from Belfast a temporary bulkhead and shell plates had to be erected to make it watertight. These have now been removed, and the work of joining the two portions is progressing rapidly, but will not be completed before early in the New Year. In addition to this work Messrs. J. & E. Hall, of Dartford, Kent are insulating the chambers in the new bow portion to enable refrigerated cargo to be carried.

Messrs. Harland & Wolff's Repair Shops. Work is progressing rapidly on the extensive and up-to-date repairing shops and office buildings which Messrs. Harland & Wolff are building near the Trafalgar Dry Dock. A large number of workmen are engaged on the premises, and several machines have already been erected, and it is anticipated that some of the work in connection with the *Suevic* will be executed in these new shops, and that before the end of the year the firm will be able to undertake all classes of repair work.

New Generating Sets. In order to meet the increasing demand for electric current due to the large dock extensions, etc., the London and South-Western Railway Company have just installed two new generating sets in their large power station near the Trafalgar Dock. Each set comprises a triple expansion inverted direct acting steam engine directly coupled to an eight-pole continuous current generator. The engines are by Messrs. Gourlay Bros., of Dundee and have cylinders 16 in. by 23½ in. by 36 in. with a stroke of 14 in., and run at 350 revolutions with a steam pressure of 135 lbs. per square inch at the engine stop-valve. They are of the enclosed type having forced lubrication. The generators are eight pole machines designed to give an output of 500 K.W.S. the voltage being 480 on the three-wire system. They have been supplied by the British Westinghouse Co. The station also contains 6-3 cylinder compound vertical engines with cylinders 8 in. by 14 in. by 14 in. and 10 in. stroke, the H.P. cylinder being in the centre. Each engine drives a continuous current six pole generator also by the British Westinghouse Co. capable of giving an output of 75 K.W.S. at 350 revolutions. The engines are supplied with steam by five locomotive boilers located in a large boiler-house.

The Royal Mail Steam Packet Company are making extensive alterations and additions to their steam laundry at Shirley in order to cope with the increased work in this department due to the large increase in the number of vessels owned by this company now sailing from Southampton. Messrs. Tangye & Co. of Birmingham, are supplying a large suction gas plant and horizontal gas engine capable of delivering 88 B.H.P. per hour, to drive the whole of the machinery. Also Messrs. D. & J. Tullis, Limited of London, and Kilbowie Ironworks, Clydebank, N.B. are supplying three 36 in. by 54 ft. heavy type low pressure washing machines, three 30 in. self balanced hydro extractors and one 12 in. by 104 in. four roller ironing machine.

BELFAST.

(From our Own Correspondent.)

Messrs. Harland & Wolff. Up to the time of writing this firm had not launched any new tonnage during the month of November. They have, however, one or two large steamers to put in the water before the close of the year. They recently got delivery of the pontoon built for them in Greenock, which is to carry the 150 tons floating crane intended for shipping machinery on new vessels. The contract for the construction of the crane was secured by a German firm, who have already started upon its erection. In this connection the Harbour Commissioners have decided to spend a sum of £45,000 odd in strengthening the tramway line which runs down the Queen's Road to the Alexandra Wharf, with a view to its being able to carry much heavier loads than it is at present capable of and in constructing tramway lines along Victoria Wharf alongside which the new floating crane will be used.

Messrs. Workman, Clark & Co. are reported to have received an order for the construction of two Holt liners having a length of 440 feet beam of 5? feet and depth of 35 feet. In the last week of October they launched a new steamer named *Veidt* for Messrs. Lamport & Holt having a length of 415 feet and a gross tonnage of 6,300. She has been specially designed and constructed for the owners' South American passenger and cargo trade. On the 30th of October they had a successful trial of the new steamer *Nerehana*, built and engined by them for the Tyser line. The *Nerehana* is 460 feet long and has a gross tonnage of 6,000. The propelling machinery consists of two sets of triple-expansion engines supplied with steam by four single-ended boilers working under Howden's system of forced draught.

Alexandra Graving Dock. Very satisfactory progress has recently been made with the reconstruction of the outer end of this dock. The caisson has been placed in position and the dock pumped dry. The cofferdam which was built across the entrance is being removed and in all probability the graving dock will be ready for use by the New Year.

More Strikes. Shortly after the settlement of the moulders' strike the local patternmakers demanded an increase of wages; and as the employers could not see their way to granting the advance, the men have gone out on strike. At the time of writing there is no immediate prospect of the dispute being settled and already numbers of hands in other departments have had to be suspended. The men have been ill advised in adopting the extreme method of enforcing their demands, and should no agreement be come to before long their action is bound to bring suffering upon hundreds at a time of year when want of money is a double hardship.

There is also at present further trouble with the men employed in the discharge of the colliers trading between

the English, Scotch and Welsh ports and Belfast. They have gone out on strike owing to the employment at the coal quay of one or two men who did not belong to their own particular society. These men with whom the others object to work are members of an opposition society which was formed shortly after the settlement of the recent big strike in this trade, and the strikers' action is a distinct violation of one of the terms of the agreement then arrived at; namely, that the coal merchants should be allowed to employ whom they liked, whether they belonged to any society or not. To make matters worse the cranemen who are in the direct employment of the harbour authorities have thrown in their lot with the strikers, owing to the dismissal of one or two of their number who refused to work their cranes at an affected steamer. Things are practically at a standstill at the quays, a whole fleet of coal-laden steamers lying idle. One or two vessels have been discharged by hand, but the operation was necessarily of a tedious nature. Situated as Belfast is, this dispute, if prolonged even for a week or two, will have a very serious effect upon the trade of the city. Even now several large mills are face to face with the prospect of having to shut down should a settlement not be shortly arrived at.

JUNIOR ENGINEERS.

XV.*

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Smithing *(continued)*.

THE ball lever, Fig. I, is a fairly common type and is often fitted to the wyper shaft of reversing gears. The smaller sizes, if used in sufficient numbers, are frequently made to standard dimensions by means of dies, in which case the lever is roughly formed to shape and finished off either under the steam hammer or in the forging machine, thus producing more quickly a well-finished article, something of a consideration when the lever is not to be put in the lathe.

With the larger sizes the length is more apt to be varied, as well as the ends, and these are then worked up with the swages alone. A round bar is taken, of a diameter to form the larger ball, and brought to a good welding heat at one end; sufficient for the shank and smaller ball is marked off as at A, Fig. II., and then a piece for the large ball having been allowed for, the bar is cut partly through as at B, leaving the rest of the material to hold on by.

Starting now from the end C the bar is cogged down, as shown in Fig. III, by a series of indentations, working back to the large end successively, till the end C is small enough for the ball and the shank has been brought roughly into shape, the material is then rounded up by means of set hammers and finally the swages applied as at Fig. IV.; the bottom swage is placed in the square hole in the anvil block and the top swage held by means of a handle under the hammer.

The lever is now held at this finished end, the bar cut away and the cold end heated and brought down to shape by means of the hammer and finished in the swages to form the larger ball.

It is not usual to make the holes in the balls, these being bored out, but in other cases where a hole may be required to be formed the punch used is merely a round steel rod of convenient length with a handle attached to the head, this is struck by the hammer till half-way through the material, which is then reversed and the punch again applied the blae being thus cleared as it passes out leaving a clean hole.

Where the article is finished in a press complete a hole may be required in such instances a die or bolster as in Fig. V. is employed. The body of the die is of wrought iron or steel having in the lower portion a tapered hole that will allow the blae to pass and the upper side recessed out to whatever shape may be required. A circular steel ring is bedded into the block, its internal diameter that of the hole required, which can be renewed when worn out of shape. Both the ring and the punch are of a good quality steel and tempered; the punch is tapered slightly to prevent it jamming, the bottom and larger end just sufficient to pass through the ring. A guide plate is fitted to the top of the bolster to keep the punch in line.

* For Articles I. to XIV., see last fourteen issues.

In forming a flange round a hole in a plate a tool such as in Fig. VI. is frequently employed; a hole is punched in the plate, according in diameter with the depth of flange required, the tool is placed in position and driven down by the hammer, thus forming the flange to the dotted lines, the tool passing right through. A renewable steel ring here also takes the force of the blow, and in order to prevent the metal from splitting or thinning down at the edges another ring is placed in the bottom of the block.

Frequently a forging or part of one is formed from a flat plate, in this case the die is recessed to the required shape and the punch embossed. In order to allow the job to release itself from the die a slight taper is given to the sides, termed draft or clearance.

The working surfaces of both die and punch are of good quality steel case-hardened, but the supports and handles may be of wrought iron, secured to the dies by riveting or welding. In some cases it is advisable to keep the punch soft, so that it can be hammered up to shape again when worn, and with heavy work the effect of the concussion is less severe on the soft than on the hardened material and a poorer quality steel is therefore often employed.

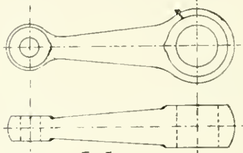


FIG. I.

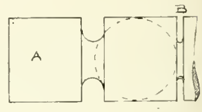


FIG. II.

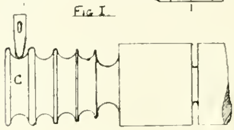


FIG. III.

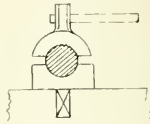


FIG. IV.

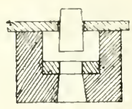


FIG. V.

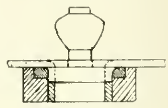


FIG. VI.

In marine work dies and forging machines have not hitherto been so largely adopted as in railway, motor car, and small machine establishments, partly due to the heavier and rougher class of article and partly to the difficulty in standardizing. Other methods also have come into competition with die work and the introduction of high-speed machine tools and steel has often resulted in parts of more or less regular and round form being cut entirely from the bar in turret lathes where the number required is sufficiently large and the difference in diameters not too great.

There are however, some cases where dies may be used with advantage for instance the Muntz metal spindles for wing valves are often required of other than standard lengths and therefore not cut from the bar, unless several are needed alike; the collar end fitting into the valve head does not require machining if the die be employed, and the forging can be made much nearer the finished size, so that the cost of the die is soon covered by the saving in machine waste alone.

In the manufacture of large forgings, such as piston and connecting rods good scrap iron was formerly employed and although these are now invariably solid forged from the steel billet the old method is still in operation for some of the less important parts. The scrap, which has usually a large percentage of steel mixed with it, consists of cuttings from plates and bars in lengths of a foot or so and two or three inches broad; these are piled in tiers of rows, each row being set at right-angles to the one below; several of these faggots, as they are termed are introduced into the furnace brought to a welding heat and forced into a solid mass under the steam hammer.

In uniting these formed portions together a convenient length of bar is employed, termed a porter bar, strong enough to support the finished weight, a crane sling is placed round its middle and by means of a handle at one end the other is passed into the furnace, a hot faggot of scrap guided on to it, and the whole withdrawn. The two are welded together under the steam hammer and then others successively worked on till sufficient material is obtained to start the forging; this having been done more iron is added till the job is completed when it is severed from the bar and the rough end rounded off.

For making steel forgings the material is supplied in billets. By the method of hammering out from the solid the surface only is worked, the centre of the billet is scarcely acted upon and is consequently weaker than that portion which has been improved by the working. By the mechanical laws a hollow shaft is stronger for the same weight than a solid one and when is added to this the difference in quality of the material at the surface and centre the advantage gained by boring out a shaft is a considerable saving in weight although at a slightly higher cost. It is usual to forge the shaft solid to the finished forging size and then turn and bore it but in some cases of small hollow parts the job, after being simply bored, is returned to the furnace and using a mandrel the size of the bore, is again subjected to the hammer, thus producing a forging which is uniformly worked throughout, at the added extra cost of the second heating, even this being frequently dispensed with by the possibility of first boring the rough material.

OBITUARY.

Sir William George Pearce, Bart.—We have to record with regret the death of Sir William George Pearce, Bart., chairman of the Fairfield Shipbuilding and Engineering Company, Ltd., Govan, and of Cardell, Wemyss Bay and Chilton Lodge, Berks, which took place from appendicitis on November 2nd. Deceased who was in his 47th year, was the son of Sir Wm. Pearce, whose skill as a naval architect and great ability as an administrator served so notably to maintain the renown of Fairfield as the birthplace of high speed and palatial ocean steamships. Young Pearce was educated first at Blair Lodge afterwards at Rugby and Glasgow University, completing his education at Trinity College, Cambridge, where he graduated M.A., LL.B., with honours in the law tripos of 1884. He was called to the Bar at the Inner Temple in 1885, and the same year he was selected as second Conservative candidate for the borough of Dover. At the General Election of 1892 Sir William was elected member for Plymouth, and continued to represent the constituency until the following General Election. On the death of his father in 1888 Sir William succeeded as chairman of the Fairfield Company and though non resident, he took a keen interest in the business, and was in frequent communication with the offices in London and with the head-quarters at Govan. Professionally not so intimate with shipbuilding as his father he was not so widely known among naval architects and marine engineers. Even in London, where he spent most of his time, he was seldom seen at public meetings of the profession. He was nevertheless an able administrator and all his later years he exercised a strong though quiet influence over the widespread interests of the great Govan concern. He presided over the meeting of the company in October and was present at the launch of H.M.S. *Indomitable* in March last. Sir William was also largely interested in shipping and until recently filled the office of chairman to the Union Steamship Company (Limited) which passed into the hands of the Norddeutscher-Lloyd and the Northern Steamship Company (Limited), subsequently acquired by the Morgan interests. The deceased baronet resided chiefly on his Berkshire estate and farmed about 1500 acres of his own land. He was a successful breeder of Hampshire Down sheep, and took many prizes with his herd of Jersey cattle. The news of the death caused sincere regret in the burgh of Govan with which the family have for over a generation been so closely associated. For his mother Lady Pearce deep sympathy is felt, she having endeared herself to the whole community by her noble character, the number and extent of her public benefactions, and her unostentatious private charity. Sir William was married in March 1905 to Caroline Eva, daughter of the late Robert Coote.

REVIEWS.

Present-Day Shipbuilding. By Thos. Walton. London: Chas. Griffin & Co., Ltd. 1907.

In the preface the author discusses the general improvements that have taken place in ship construction in recent years, and he endeavours to show what form these take, adapting himself to the necessities demanded by examiners in naval construction. This is a fairly large and comprehensive work and just the general principles that the Societies demand are touched upon. The author's methods are practical in every way. He is clear as to the kinds of framing employed to give hold space for cargo with as few beams as possible together with the various systems of construction which will obtain for a vessel the approval of the classification society. He then discusses types of ships and how the selection is determined. The author is very complete with plans and figures. He takes first one and two-deck types then spar deck followed by awning-deck. Modifications of these come next. Actual ships, such as the *Lusitania* and the *Mauretania* are shown with sections and general views, among which is the plan of the Tyne and the positions of the *Mauretania* after launching, with the diagram of calculations employed for this important event. Some particulars are also introduced as regards the *Campania* and *Lucania*. Turret-deck steamers follow, very completely illustrated then trunk steamers and the self trimming design of Messrs. Priestman & Co., as well as cantilever-framed ships. Special designs like those for Messrs. Alf. Holt & Co., of Liverpool, we can only refer the reader to for himself. Oil-tank boats are very closely discussed as in all the other cases with full plans.

In Chapter IV. the author goes into minute details of construction. We cannot speak too highly of this section. There is the preparation of the keel blocks and all the beams and frames, with bulkheads and openings. Next there is the outside plating and all the after end of the ship with the important details comprised therewith. The general pumping arrangements of vessels are treated here with the rules applying, and we find also the usual methods of launching at the end, before concluding with text questions and answers. In this of necessity rapid survey, we have only been able to point to a few of the leading features, but the book is certainly what it claims to be an epitome of present-day ship construction from a perfectly practical and utilitarian point of view.

Electrical Power and Traction. By F. H. Davies. London: Constable & Co., Ltd., 1907.

Electricity as a power is so much in evidence to-day that one branch develops another, but there is a common basis to them all. The student, therefore, is left in a great measure to select details for himself, it being very unlikely he can find between any two covers all he may want in the way of information. Here we have first the generation and distribution explained, with the type of dynamo and wiring adopted according to circumstances. Having given the systems generally in use the author proceeds to show what we are likely to have in store for us in the way of increased power in the future and then discusses the plans that will possibly be employed. He shows the voltage that is being used in America, which amounts to as much as 60,000. The chapter on motion is of value. We see the type to be adopted for various classes of work. Having given the three classes of direct current motors, the action of the starter is explained. This is followed by a description of alternating current and the applications of electric power in workshops, collieries, hauling and pumping. The importance of engineering is such that a chapter is specially devoted to the subject and lathes, cranes, punching machines and portable drills are discussed therein. Other trades affected are the cotton and printing, while in marine work, after the advantages of electric power are shown we have the type of generator employed in the Navy noticed, also the operations that are affected. This goes as far as turret turning and water tight door manipulating. Haulage on canals comes next and the opinion is expressed that this system is a great saving over self propulsion. Traction proper then has attention and naturally from the title of the work we expect to find all applications noticed. These are for tramways and railways, with the examples of the Metropolitan and District lines, the Central London being also mentioned. Several tracks abroad are noticed and the proposed equipment for the L.B. & S.C. also. This volume is of a practical character throughout and is likely to be appreciated accordingly.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Cubatao.—On October 21st Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely-modelled twin-screw steamer of the following dimensions:—286 ft. by 44 ft. 9 in. by 17 ft. 6 in. She is designed to suit the special trade of the Lloyd Brazileiro, and is of the single-deck type, with deckhouses amidships and forecastle forward, and is built under special survey to class with the British Corporation. The vessel has double bottom for water ballast in the holds and has also water ballast in the peaks. She is fitted with patent vertical steam windlass with quick warping ends, by Clarke, Chapman; Hastie's Wilson-Pirrie patent steam steering gear, placed in house aft, and worked from bridge amidships by telemotor; eight steam winches; double derricks for rapid loading and discharging, with gins and blocks having Reid's patent sheaves; Clayton fire and disinfecting machinery; electric light by Siemens Bros., and all modern improvements for a first-class cargo steamer for the Brazilian trade, including Messrs. Wailes, Dove's patent bitumastic enamel, applied to structures in double bottom fore and aft Christie's patent sparring cleats, Litosilo to cabins, Hoskin's beds, whilst the lifeboats have Mill's disengaging gear. The machinery has been constructed by Messrs. Blair & Co., Ltd., Stockton-on-Tees, and consists of two sets of triple-expansion engines 14 in., 22 in., 37 in. by 24 in., with two large steel boilers, working at 185 lbs. pressure. The vessel has Vicker's patent stern tube appliances, and a very full specification. Messrs. S. T. Taylor & Sons, Newcastle-on-Tyne, have covered the boiler bottoms with their "Tynos" patent removable asbestos mattresses. This is the sixth vessel Messrs. Craig, Taylor & Co., Ltd., have built for the Lloyd Brazileiro, and they have two similar vessels now under construction for them. The vessel has been built under the superintendence of Captain A. Rosauro de Almeida, assisted by Mr. H. Hudson and Mr. Newrick. As the vessel left the ways she was gracefully christened the *Cubatao* by Mrs. Newrick.

Lynrowan.—On October 21st, Messrs. R. Craggs & Sons, Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer, 361 ft. long by 47 ft. 6 in. beam by 24 ft. 8 in. depth moulded. This vessel is being built under special survey to take the highest class at Lloyd's, being of the shelter-deck type. The specifications of both hull and machinery are very complete in every way to fulfil the owners' special requirements. Cellular double bottom is fitted throughout for water ballast, which is also carried in the fore and after peaks, the total amount being about 1100 tons. A special feature of this vessel's construction is the arrangement of clear holds, the deck being supported upon girders and wide-spaced mast pillars placed well clear of hatch sides. The construction of hull and machinery has been carried on under the superintendence of Messrs. Maxton & Sinclair of Liverpool. Eight powerful steam winches are provided of the most approved type, steam steering gear is also supplied, and improved quick-warping steam windlass is fitted forward. The arrangements for handling ship and cargo are most complete in every respect. The machinery will be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, and will have cylinders 24 in., 41 in., 67 in. by 45 in. stroke, steam being supplied by two large boilers working at 180 lbs. pressure to the square inch, fitted with Howden's forced draught. The vessel has been built to the order of the Liver Shipping Co., Ltd., of Liverpool (Messrs. Johnstone, Sproule & Co., managers) and on leaving the ways was named *Lynrowan* by Miss Sproule.

Westerwald.—On October 22nd Messrs. Furness, Withy and Co., Ltd., Hartlepool, launched the first of three large passenger steamers for Messrs. the Hamburg Amerika line, over 360 ft. in length and built to Germanischer Lloyd and See Berufs Genossenschaft rules. These vessels are intended for the West India trade and will be rigged as two-masted fore and aft schooners, built on the deep frame principle, with two complete steel decks and long bridge, poop and forecastle and long boat deck fitted amidships, all weather decks are sheathed with teak. The hull is divided into ten water-tight compartments by means of nine water-tight bulkheads fitted in accordance with German Board of Trade requirements for ocean passenger steamers. Cellular double bottom extends the full length of holds and engine and boiler space for water ballast, the fore and after peaks being also available as trimming tanks. There are five large cargo hatches worked by eleven powerful steam winches, the latter being supplied and fitted by Messrs. Furness, Withy & Co., Ltd., seventeen derricks, two of which are capable of lifting 15 tons each; the derricks are made of patent Mannessmann tube. The vessels will be lighted throughout by electricity, and the installation, consisting of two dynamos, will be supplied by the shipbuilders. The equipment also includes direct steam patent windlass, patent Telemotor gear, steam heaters, winch condenser, steam ash-hoist, See's ash ejector, fresh-water condenser, eight boats with davits of Mannessmann tube, awnings all fore and aft. The 'tween decks are arranged to carry 608 third-class passengers, and are fitted with Hoskin's patent Neptune berths; thirty first-class passengers are accommodated in the bridge, and a fine dining saloon, smoking-room and ladies' saloon are arranged on the bridge deck; the poop is fitted up as a hospital. The crew are berthed in the forecastle, while the captain and officers are berthed in a large deckhouse on the boat deck. Engineers' berths, stewards', butcher's shop, baker's shop, galley, first-class lavatories, etc., are all arranged in the bridge deck. Insulated store-rooms are fitted up in the after-hold and 'tween decks, and a refrigerating plant will be supplied by Messrs. J. & E. Hall. Triple-expansion engines willl be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, the diameter of cylinders being 25½ in., 43 in., 72 in. by 48 in. stroke of piston, and steam will be supplied from three single-ended boilers, 14 ft. by 12 ft. working at a pressure of 200 lbs. per square inch; Howden's system of forced draught will be fitted in connection with the boilers. The vessel has been built under the personal supervision of Mr. Wilke and Mr. Hatje on behalf of the owners. The christening ceremony was gracefully performed by Mrs. Alwyn W. Middleton, daughter of R. W. Vick, Esq., J.P., West Hartlepool who named the vessel *Westerwald*.

Ibo.—On October 23rd, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough, the fine steel screw passenger and cargo steamer *Ibo*, built to the order of Messrs. Empreza Nacional de Navegacao, of Lisbon. She is built to Lloyd's 100 A1 class, awning-deck rule, her principal dimensions being 210 ft., 30 ft. 2 in. by 18 ft. 7 in. moulded, with a deadweight carrying capacity of about 700 tons on a light draught of water. The accommodation for officers and engineers is placed in large steel deckhouses forward of engine and boiler casings, while the crew is berthed under awning-deck forward. The awning 'tween deck is lighted and ventilated, so that emigrants can be carried here when found necessary, and the vessel has a complete installation of electric light. The upper deck is of steel, and main deck of pitch pine. Triple-expansion engines placed aft, will be fitted by the North Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 13 in., 21 in. and 35 in. by 24 in. stroke, supplied with steam by one large boiler working at 180 lbs. pressure. The vessel and her engines are being constructed under the superintendence of Mr. T. C. Laws of Liverpool the owners' representative in England.

Slieve Bloom.—On November 5th, the *Slieve Bloom*, the first of two steamers built to the order of the London and North-Western Railway Co., was launched at Vickers' Works, Barrow. With a view to maintaining a thoroughly efficient service between England and Ireland, the railway placed an order for two twin-screw steamers which are designed for the intermediate service. Mrs. R. McInnes, daughter-in-law of one of the directors of the L. & N.W. Railway, performed the ceremony. These vessels which will run between Holyhead and North Wall Dublin are designed to carry on limited dimensions a large cargo, together with a considerable number of passengers, and yet are to maintain under economical steaming conditions a service speed of 16 knots. In the equipment of the *Slieve Bloom* regard has been paid to the carriage of produce in the increasing export of which to the United Kingdom, Ireland is improving her financial position. A notable feature is the care with which the designers have worked out the details of the extensive accommodation for the transport of cattle and horses. Ventilation of the cattle decks is ensured by powerful electric fans.

Special boxes are built in the ship for stud, show and other valuable animals. The drainage of the cattle decks is a feature; it is collected into sludge tanks which can be flushed out at sea. The safety of the cattle in heavy seaways has been carefully considered, and to minimise the rolling and pitching of the ship—of as much importance in cattle as in passenger ships—deep ballast tanks at each end of the fore-hold and of the after-hold have been provided, in addition to the forward and ballast tanks for trimming the ship. The following are the dimensions of the new vessel: Length overall, 310 ft. 10 inches; breadth moulded, 37 ft.; depth moulded, 15 ft. The vessels are built to class A1 Channel service at Lloyd's, and have three decks right fore and aft, *viz.*: lower, main and weather decks. The vessel will be provided with a Board of Trade certificate to carry over 1,000 passengers, shelter spaces and other conveniences fore and aft being provided for their accommodation. Commodious and comfortable accommodation is also provided for the cattle dealers. The main and lower decks are entirely fitted up with stalls for the carrying of cattle and horses. The principal officers are accommodated in deck-houses on the weather deck. Both vessels will have two masts and appliances for the quick discharge of cargo. Steam heating is fitted in all living spaces and the vessel is entirely lit up with electric light. The propelling machinery consists of two sets of four-crank triple-expansion engines arranged on the Yarrow Schlick and Tweedy system so as to obtain freedom from vibration. The equipment embodies the latest up-to-date practice for cross-Channel steamers. The high-pressure cylinder in each engine is 19 inches in diameter, the intermediate 29½ inches, and the low-pressure 33 inches. Steam is supplied at a working pressure of 180 lbs. per square inch by two double-ended boilers working on the Howden system of draught, and the whole of the machinery has been built to the requirements of the Board of Trade and Lloyd's Register of Shipping.

Buffalo.—On November 6th, the launch took place from the yard of Earle's Shipbuilding and Engineering Co. Ltd., Hull, of a handsomely modelled screw steamer built to the order of Messrs. Thomas Wilson Sons & Co. Ltd. for their cargo trade between Hull and New York. The vessel on leaving the ways was christened the *Buffalo* by Mrs. W. S. Hide, wife of the superintendent engineer Messrs. Thomas Wilson, Sons & Co. Ltd. The principal dimensions are: Length, 377 ft., breadth moulded 49 ft., depth moulded 30 ft. The vessel has been built of steel to the British Corporation Registry's highest class and to Board of Trade requirements, also the American regulations for carriage of cattle and is fitted for carrying a large quantity of water ballast in the cellular double bottom and in forward and after-peak tanks. It is estimated the vessel will carry about 7,000 tons dead weight; a deck house has been provided amidships for the accommodation of the captain, officers and stewards. The engineers, firemen and cattlemen are berthed in sidehouses abreast engine and boiler casing, and the petty officers apprentices, and seamen under shelter deck forward. She is of shelter-deck type and will be fitted with two steel masts two steel derrick posts each complete with derricks and all necessary cargo gear also stronger derricks for heavy loads. There are nine powerful steam winches of Messrs. Lynn & Co.'s special make, steam windlass by Messrs. Clarke Chapman and Co., and steam and hand steering gear by Messrs. Amos and Smith the latter fitted in the wheel house aft. The machinery consists of a set of quadruple expansion engines having cylinders 22 in., 31½ in. 45 in. and 66 in. by 51 in. stroke supplied with steam at 215 lbs. per square inch by two extra large single ended boilers fitted with superheating and forced draught apparatus. Economy in coal consumption and in up keep of engines and boilers has been carefully considered in the design of the machinery all working parts and bearing surfaces are exceptionally large being of such proportions as will ensure the engines running at high power over extended periods without the necessity of adjustment.

Arabiana. On November 7th Messrs. Irvine's Shipbuilding and Dry Docks Co. Ltd. West Hartlepool launched the handsome steel screw steamer *Arabiana* built for the Furness line. She is of the following dimensions 336 ft by 47 ft by 24 ft. 10 in having single deck poop bridge and top gallant forecastle and has been built to the British Corporation Registry's highest class. A double bottom is fitted throughout on the cellular principle and the fore and after-peak tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stringers, giving clear holds for the storage of bulky cargoes. Five water tight bulkheads divide the holds into six watertight compartments wood grain divisions are fitted in the holds. She also has extra large cargo hatches, five steam winches, which are supplied with steam from a vertical multitubular Cochran (Annan) donkey boiler, fitted with patent seamless furnace and is replete with all the latest improvements for rapid loading and discharging. A powerful quick warping steam windlass is fitted forward for the working of the cables, and steam steering gear is fitted amidships with hand screw gear aft. Accommodation for captain and officers is arranged in poop, engineers in houses amidships crew and firemen in forecastle. The sanitary ventilating and lighting arrangements have received special attention and have been effected on the most approved lines. Triple-expansion engines are being supplied and fitted by Messrs. Richardsons Westgarth and Co., Ltd., Hartlepool having cylinders 24 in., 38 in., 64 in. by 42 in., two large S.E. boilers, 160 lbs. pressure. The vessel was named *Arabiana*.

Harlseywood.—On November 7th, Messrs. Ropner & Sons Ltd. Stockton-on-Tees launched from their yard a steel screw steamer of the following dimensions *viz.*: Length 328 ft., breadth 46 ft depth 21 ft. The vessel will be classed 100 A1 at Lloyd's, having main deck poop, bridge and topgallant forecastle, accommodation for captain officers and engineers in houses on bridge deck, crew in the forecastle. The vessel has double bottom for water ballast on the cellular principle and in after peak. She will be fully equipped with an up-to-date outfit including quick-warping steam windlass stockless anchors steam steering gear amidships, and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete and include six steam winches, steam being supplied by a large donkey boiler. The holds are entirely clear of obstructions to stowage of cargo having centre line pillars only. The engines will be of the triple expansion type by Messrs. Blair & Co. Ltd., Stockton-on-Tees, of about 1100 I.H.P., having two steel boilers 14 ft. 9 in. by 10 ft. for 160 lbs. steam pressure. The vessel has been built for Messrs. The Constantine & Pickering Steamship Co., Middlesbrough and the christening ceremony was gracefully performed by Mrs. Pickering of Hutton Hall Guisbro, who gave her the name of *Harlseywood*, this being after the village of Harlsey.

Avon. On November 9th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders Selby a handsomely modelled steel screw trawler the principal dimensions being 125 ft. by 22 ft. by 12 ft. 6 in. depth moulded. The vessel has been built to the order of Messrs. Jetts Bros., of Grimsby and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co. of Hull and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Avon* by Miss Olive Caroline Jetts, of Grimsby, after which the company adjourned to the builders offices, where breakfast was served and the customary toasts given and responded to.

Coltman.—On November 11th, there was launched from the yard of Earle's Shipbuilding and Engineering Co. Ltd., Hull, a handsomely modelled steel screw trawler, which has been built to the order of Messrs. the City Steam Fishing Co., Ltd., Hull. The dimensions of the vessel are 141 ft. 8 in by 23 ft. by 13 ft. moulded and has been built under special survey for 100 A1 class at Lloyd's with scantlings in excess of their requirements. The vessel has been built for the White Sea and Iceland trades, and is fitted up complete with boat davits turtle deck and stern hood together with all the latest improvements in fishing gear. The machinery which is being supplied by the builders consists of a set of triple expansion surface condensing engines with cylinders 13 in. 22 in. 37 in. by 24 in. stroke working at a pressure of 200 lbs. per square inch. As the vessel left the ways she was gracefully christened the *Coltman* by Mrs. W. J. Stephenson and amongst those present were Mr. F. Laverack (Town Clerk) Mr. J. A. Laverack (managing director of the City Steam Fishing Co. Ltd.) Mrs. J. A. Laverack Mrs. Bates, Mr. Lister Captain and Mrs. Ingle Mr. A. Roberts Mr and Mrs. J. Watson Misses Watson Mr. F. Somerscales and other officials of Earle's Company. After the launching ceremony

the visitors adjourned to the Board Room where breakfast was served. Mr. Somerscales presided and wished success to the *Coltman*. He observed that this ship was the fourth Earle's Company have constructed for the City Steam Fishing Company, and he hoped they would soon favour his Company with further orders. Mr. J. A. Laverack, in replying, stated that he was pleased to say that the vessels already built by Earle's Company had given a good account of themselves, and he anticipated that the ship launched this morning would prove equally satisfactory. Mr. E. Laverack, in rising to propose success to Earle's Company, referred to the death of Lord Nunburnholme, which he greatly deplored. He felt that the purchase of Earle's works by his lordship at a time when there seemed every probability of their being closed was of incalculable benefit to the city of Hull by reason of the large number of men who are employed there. He wished the Company under its improved and altered conditions and organization every success.

Queen Alexandra.—On November 14th, there was launched by Mr. Edward Hayes Stony Stratford, a steel towing launch for Egypt. Size 51 ft. by 11 ft., 4 ft. draught. Engines C.S.C. 8 in. and 16 in. by 10 in.

Bilbster.—On November 18th, Messrs. Richardson, Duck and Co. launched from their yard a steel screw steamer of the following dimensions, *viz.*: Length overall, 368 ft. 6 in.; breadth extreme, 51 ft.; depth moulded, 29 ft. 5 in.; deadweight capacity, 7500 tons. This vessel, which has been built to the order of Messrs. Arthur Hill Gunn and Ernest Gunn, of Cardiff, will class 100 A1 in Lloyd's Register, and has been built under special survey. She is a single-deck steamer, built to the three-deck rule, with poop for cargo, bridge and topgallant forecastle. Accommodation for captain, officers and engineers is provided in steel deck-houses on bridge deck, crew being berthed in topgallant forecastle. A cellular double bottom throughout and peak tanks are fitted for water ballast, and equipment includes seven steam winches horizontal multitubular donkey boiler steam windlass with quick-warping ends stockless anchors, steam steering gear, etc., etc. The engines, by Messrs. Blair & Co., Ltd., have cylinders 25 in., 42 in., and 68 in., with a stroke of 48 in., steam being supplied by two single-ended boilers having a working pressure of 160 lbs. The vessel during her construction has been supervised by Mr. Thos. A Reed, consulting engineer, of Cardiff. As the vessel left the ways, she was christened *Bilbster* by Miss Olive Gunn, daughter of Sir John Gunn.

Cedarwood.—On November 20th, Messrs. W. Harkess and Son Ltd., launched from their shipbuilding yard at Middlesbrough, a finely-modelled steel screw cargo steamer, which they have built to the order of the Meteor Steamship Co., Ltd., of Middlesbrough. The principal dimensions are Length 176 ft., breadth 29 ft. 10 in., depth moulded 13 ft. She will carry about 900 tons on about 12 ft. 6 in. draught on a very low net register tonnage; her engines, by Messrs. Blair & Co. Ltd., of Stockton-on-Tees, are intended to drive her a speed of 10 knots loaded. On leaving the ways she was gracefully christened *Cedarwood* by Mrs. Thos. H. Donking, of Linthorpe. The vessel has been built under the superintendence of Wm. Constantine, Esq., of Middlesbrough.

Ibiapaba.—On November 21st, Messrs. Craig, Taylor & Co. Ltd. launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, the seventh vessel they have built for the Lloyd Brazileiro, and similar to the *Cubatao*, as reported on page 194. As the vessel left the ways she was gracefully christened the *Ibiapaba* by Mrs. Robinson.

Spreewald.—On November 21st, Messrs. Furness Withy and Co. Ltd. Hartlepool, launched the second of three large passenger steamers which they have on order for Messrs. the Hamburg Amerika Line, the vessels being 366 ft. long and built to Germanischer Lloyd and See-Beruf Genossenschaft rules for ocean going passenger steamers. The vessels are intended for the West Indian trade and will be rigged as two masted fore and aft schooners, built on the deep frame principle with two complete steel decks and long bridge, poop and forecastle, with long boat deck amidships. All weather decks are sheathed with teak. The hull of the vessel is divided into ten water tight compartments, by means of nine water tight bulkheads fitted in accordance with German Board of Trade requirements for ocean passenger steamers. Cellular double bottom extends the full length of holds and engine and boiler space for water ballast, the fore and afterpeaks also being available as trimming tanks. There are five large cargo hatches worked by eleven powerful steam winches, the latter supplied and fitted by the builders, and seventeen derricks, two of which are capable of lifting fifteen tons each. The derricks are made from patent Mannessmann tube. The vessels will be lighted throughout by electricity and the installation, consisting of two fine dynamos, will be supplied by Messrs. Furness, Withy & Co., Ltd. The equipment also includes direct steam patent windlass, patent Telemotor steering gear, steam heaters, winch condenser, steam ash-hoist, See's ash ejector, fresh-water condenser, eight boats with davits of Mannessmann tube and awnings all fore and aft. 'Tween decks are arranged to carry 608 third-class passengers, and are fitted with Hoskin's Neptune berths, whilst thirty first-class passengers will be accommodated in the bridge. A fine dining saloon, smoking saloon and ladies' room are arranged on the bridge deck. The poop is fitted up as a hospital. The crew are berthed in the forecastle, while the captain and officers are berthed in a large deck-house on the boat deck. Engineers' berths, stewards', stewardesses', butcher's shop, baker's shop, galley first-class lavatories, etc., are arranged on the bridge deck. Insulated store-rooms are fitted up in the after-hold and 'tween decks, and a refrigerating plant will be supplied in each case by Messrs. J. & E. Hall, Ltd. Triple-expansion engines are being supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, with cylinders, 25½ in., 43 in. 72 in., and 48 in. stroke, steam being generated in three single-ended boilers, 14 ft. by 12 ft., working at a pressure of 200 lbs. per square inch. Howden's system of forced draught will be fitted in connection with the boilers. The vessels are being built under the personal supervision of Mr. Wilke and Mr. Hatje on behalf of the Company and the *Spreewald* on leaving the ways was christened by Miss Winnie Siveright.

LAUNCHES—Scotch.

Pontoon.—On October 25th, the Greenock and Grangemouth Dockyard Company, Limited, launched from their shipbuilding yard at Greenock a large crane pontoon, dimensions 150 ft. by 86 ft. by 13 ft. This has been built for Messrs. Harland & Wolff, shipbuilders, Belfast, and is to carry the largest crane in the world to lift the gigantic weights required for their mammoth ships. The crane is being constructed by Messrs. Benrather Maschinenfabrik Actiengesellschaft Benrath, Germany, and is to lift 150 tons to a height of 150 ft. and revolve right round on a radius of 100 ft. The pontoon has been constructed with 15 water-tight compartments and has been specially designed by the builders so that it will be capable of taking the strain of the above load of 150 tons when revolving, and also so that the 150-tons load can be deposited at any place on the deck, the deck being specially strengthened for this purpose. The pontoon has been built to the design of the Greenock and Grangemouth Dockyard Company, Ltd., who are responsible for the strength of the structure. Before work was commenced the design and calculations were submitted to expert German constructors and the calculations completely verified.

Ophir.—On November 9th, there was launched from the Ayr Yard of the Ailsa Shipbuilding Co., Limited, the handsomely-modelled steel screw steamer *Ophir*, built to the order of Messrs. The Zillah Shipping and Carrying Co., Limited, Liverpool, for their extensive coasting trade. On leaving the ways the vessel was gracefully christened by Mrs. W. A. Savage, Warrington. The steamer will be shortly towed to Glasgow to receive her machinery, which is being constructed by Messrs. Ross & Duncan, Govan.

Wyreema.—In the present depression of shipping our shipowners have few inducements to place orders for new tonnage. Shipyards are now so numerous, and the facilities for turning out work so great, that it is only during periods of universal prosperity that all the yards can be fully employed, and the shipbuilding trade is naturally feeling the pinch of the present hard times. It is satisfactory however, to know that this depression does not seem to have affected the shipping trade of the Antipodes judging from the number of orders placed recently with our shipbuilders by Australasian owners.

During the last few months most of the new vessels contracted for have been either for the Australian coasting trade or for lines running between this country and Australia, and in this connection it is interesting to record the launch on November 27th of the *Wyreema*, a twin-screw passenger steamer of 6,000 tons, for the Australasian United Steam Navigation Co. Ltd., of Melbourne, a company which has a close connection with the old-established British India Steam Navigation Co. The *Wyreema* has been built by Messrs. Alex. Stephen & Sons, Ltd., of Linthouse, who have secured a large share of the Australian orders, as amongst the vessels building at Linthouse may be mentioned a large twin-screw passenger steamer for the Union Steamship Co. of New Zealand, and a high speed coasting twin-screw steamer for the Howard Smith Co., for whom Messrs. Stephen built the *Cooma*, which was delivered recently in Melbourne. The *Wyreema* is an enlarged and improved edition of the *Wyandra*, built some years ago by Messrs. Stephen for the same trade and owners, and her dimensions are 4.. ft. B.P. by 54 ft. beam by 4. ft. depth. She has been designed to carry a large number of first and second-class passengers, all fore and aft on three decks, all being fitted in the high class style now found necessary in the Australian trade. The first class state-rooms are specially large to accommodate the beds, as the ancient seafaring method of beds fitted one above another has been discarded. The second-class has also been greatly improved and is quite equal to ordinary first-class. The first and second-class saloons, social hall and smoke-rooms are large, airy apartments, with decorations and fittings specially designed for the warm climate in which she will trade. Her cargo appliances, as in the other steamers of the same fleet, are hydraulic cranes fitted in pairs at each hatch, this system having been found to combine speed of loading and discharging with noiselessness in working, an important consideration in a fast coasting steamer, where cargo may be handled at any hour in the twenty-four. She has large refrigerated holds in addition to the now usual ship's cold provision chamber. She will be fitted by the builders with twin-screw engines 24½ in., 4. in. and .. in. diameter by 48 in. stroke, and six large boilers all fitted with Howden's forced draught, and is expected to attain a high rate of speed on service. Messrs. Wailes Dove & Co.'s bitumastic enamel was applied to the bunkers, and their bitumastic covering to the tank top in boiler room. The vessel was named by Miss Hodgkinson, daughter of Captain Hodgkinson, R.N.

Alexandra.—On November 8th there was launched at Leith by Messrs. John Cran & Co. a powerful screw steel tug for the Alexandra Towing Company, Liverpool. As the vessel left the ways she was named *Alexandra* by Miss Cran. The machinery of over 7.. I.H.P. will be supplied by the builders, who have two more tugs under construction for the same owners.

Orara.—On November 8th there was launched by Messrs. Scott of Kinghorn Limited, a first-class passenger and cargo steamer built to the order of the North Coast Steam Navigation Company of Sydney, N.S.W., of the following dimensions: Length 2.. ft., breadth 3. ft. . in., depth .. ft. . in. to main deck. She is handsomely fitted out for .. first and .. second-class passengers. The vessel has been fitted by the builders with a powerful set of triple expansion engines of about 2,50. I.H.P., which are supplied with steam by two large boilers, forced draught being used throughout on the Howden principle. The vessel has been built to the highest class in the British Corporation Registry, and under their special survey, and also under the superintendence of Mr. Chas. M'Allister, of Sydney, the company's consulting engineer and designer. The vessel was named *Orara* by Miss Mary D. Orr. Immediately after launching the vessel proceeded to Burntisland to take .... preparatory to running her trials.

Lombok.—On November 8th there was launched at Port Glasgow by Messrs. William Hamilton & Co. Limited, a steel screw steamer of the following dimensions: Length 4.. ft., breadth 5. ft., ..., depth .. ft. .. in. to .... built to the order of the Stoomvaart Maatschappij Nederland of Amsterdam, for their Eastern cargo and pilgrim trade. Special attention has been given to the arrangements for rapid and easy handling of general cargo, the vessel being fitted with ....

large steam winches, etc. As the vessel will also carry pilgrims, teak decks have been fitted throughout, and special arrangements have been made for their accommodation. The vessel is fitted throughout with electric light and Clayton fire extinguishing installation. The steering gear is being supplied by Messrs. Brown Brothers, Edinburgh. The vessel was named *Lombok* by Miss Pettigrew, Lynmount, Greenock. After the launch the vessel was taken in tow to Glasgow, where Messrs. David Rowan & Co. will fit the machinery, which consists of a set of triple-expansion engines having cylinders of 2.½ in., .. in., 43 in. by 72 in. by 48 in. stroke. Steam will be supplied by three single-ended boilers working at a pressure of 1.. lbs., and fitted with Howden's forced draught. The vessel has been superintended during construction by Mr. J. De Bruyn Kops, naval architect, Amsterdam, while the machinery department has been under the supervision of Mr. L. Burger, superintendent engineer for the company.

Trawler.—On November 20th, there was launched at Aberdeen by Messrs. John Duthie, Sons & Co., a steam trawler which they have built to the order of Messrs. Dickinson & Richardson, Fleetwood. The vessel is 13. ft. in length, 22 ft. in breadth and 12 ft. . in. in depth. Engines will be supplied by Mr. W. V. V. Lidgerwood, Coatbridge.

Trawler.—On November 20th there was launched at Aberdeen by Messrs. Hall Russell & Co. Ltd., a steam trawler built to the order of the Vale of Leven Steam Fishing Company, Limited, Aberdeen. The dimensions of the vessel are: length 1.. ft., breadth 22 ft. . in., and depth .. ft. The boilers and engines will be fitted up by the builders.

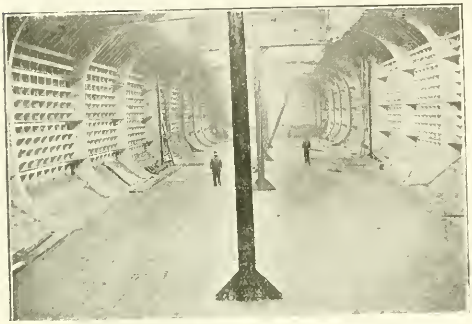
TRIAL TRIPS.

Newport News.—On October 24th the new steel screw steamer *Newport News*, of which we gave particulars in our November issue, page 1.4, built by Irvine's Shipbuilding and Dry Dock Co. Ltd., West Hartlepool, for the Furness Line, proceeded to sea on her trial. After a series of runs a mean speed of .. knots was attained, the ship and engines giving every satisfaction. Mr. Lose was present representing the owners and Mr. Urquhart the engine builders. The vessel has a Cochran Annan donkey boiler fitted with patent seamless furnace.

Patent Trunk Steamer.—On October 29th, a finely modelled screw steamer built to Norwegian account by Messrs. Ropner and Sons, Ltd., of Stockton-on-Tees, went on her official trial trip in the Tees Bay. The vessel, of which we give two views, is a large trunk steamer with one clear hold and the engines placed aft. She is built to British Corporation highest class and Norwegian Law, and is designed for the

.... the tendency of the age ... the largest possible clear holds and .... 25. ft. long and two .... ft. wide. Her dimensions .... ft. .... ft., and she will carry 7,55. .... for summer loading, and has a ....

and officers are housed in the poop, and the engineers in houses built on the poop. There is a chart-house and navigating bridge built on a narrow platform spanning the hold amidships. She has over 2000 tons of water ballast, 470 tons of which is situated above the main deck in the trunk ballast tanks, well above the centre of gravity of the vessel, thus ensuring a steady ship, and a good draught in ballast trim. These tanks and the permanent bunkers are coated with Messrs. Wailes, Dove & Co.'s bitumastic enamel. She is a self trimmer, and only such portable centre line pillars are fitted



as will be necessary to secure the shifting boards when these are required. There are no quarter-line pillars. She is fitted with eight large derrick masts and eight derricks, with nine steam winches by Messrs. R. Roger & Co., Ltd., of Stockton-on-Tees, to allow of expeditious loading and unloading of cargoes. She is fitted with electric light and also with fire-extinguishing appliances to the hold. The ballast pumps of which there are two, one by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, and the other a duplex pump by Messrs. Henry Watson & Sons, of Newcastle-on-Tyne, are capable of dealing with about 2000 tons of water ballast in six hours when pumping the tanks up or pumping out. The engines are by Messrs. Blair & Co., Ltd., 26 in., 42½ in. 69½ in. by 45 in., and two boilers 16 ft. 0 in. by 11 ft. 6 in. at 180 lbs. pressure. She has also a large multitubular donkey boiler, 11 ft. by 10 ft. 100 lbs. pressure. She has an evaporator, feed heater and Crompton atmospheric ash hoist. The trial trip passed off very satisfactorily, and a speed of about 11 knots was obtained on the measured mile. The representatives of the owner expressed themselves as highly pleased with the vessel in every respect.

Urilla.—On October 26th the steamship *Urilla* (of which we gave particulars in our October issue, page 115), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesbrough, to the order of Messrs. The Adelaide Steamship Co., Ltd., of Adelaide, South Australia, proceeded to sea for her official trials, which passed off in a most successful manner, and the vessel proceeded to Australia under the command of Captain E. A. Gibbon. Messrs. S. T. Taylor and Sons, Scotswood-on-Tyne, have covered boiler, pipes, etc., of this vessel with their "Tynos" non-conducting material. Messrs. R. T. Bruce & Co., Hull, have coated the bottom with their "Nomos" composition, and the vessel has a Cochran (Annan) donkey boiler, fitted with patent seamless furnace.

Nerehana.—On October 30th, this new steamer (of which we gave particulars in our October issue, page 117) left the ... berth at Alexandra Wharf alongside the South Shipbuilding Yard of the builders and proceeded down the Belfast Lough for adjustment of compasses and speed trials, after which she proceeded to Barry for coal, and will then go to London to take in cargo for Australia. The *Nerehana* is the fifth vessel built and engined by Messrs. Workman, Clark & Co., Ltd., for the Tyser Line. Messrs. S. T. Taylor & Sons, Scotswood-on-Tyne, have covered the boiler bottoms of this vessel with their "Tynos" patent removable asbestos mattresses.

Calcutta.—On November ...st, the steamship *Calcutta* (of which we gave particulars in our October issue, page ...5) ... on her official trial trip after adjusting compasses in Hartlepool Bay. The vessel is owned by Messrs. Nelson, Donkin & Co., London, and has been built by Messrs. Furness, Withy & Co., Ltd., Hartlepool. The trial was in every way satisfactory, the vessel maintaining a speed of 10 knots. Mr. H. M. Rogers and Mr. E. Just Flindt represented the owners, Mr. F. Bolton the shipbuilders and Mr. G. Urquhart the engineers. Messrs. S. T. Taylor & Sons, Scotswood, have covered boiler bottoms of this vessel with their "Tynos" patent removable asbestos mattresses.

Murtinho.—On November 5th, the twin-screw passenger and cargo steamer *Murtinho*, built by Messrs. Mackay Brothers, Alloa, and engined by Messrs. Aitchinson, Blair and Co., Clydebank, for the Lloyd Brazileiro ran her trials on the Forth. Under loaded conditions a full-power speed much in excess of the contract was obtained. The trial was superintended by Dr. Rosauro-de-Almeida on behalf of the owners. The vessel is fitted with a Cochran (Annan) donkey boiler with patent seamless furnace.

Ile de la Reunion.—On November 6th, the steel screw steamer *Ile de la Réunion*, of 6600 tons deadweight, built by the "Ateliers & Chantiers de France, Dunkirk," to the order of Mr. Andre Grosos, director of the "Havraise Péninsulaire Line," underwent her trials at Havre, when a speed of 11½ knots was easily obtained. This is the third vessel built at Dunkirk for these owners. Her dimensions are: Length, 340 ft., breadth, 46 ft., depth, 36 ft., with poop, long bridge and forecastle, and is classed in Lloyd's and Bureau Veritas. Handsome accommodation is provided in bridge for first-class passengers, and electric light is fitted throughout. Her engines, of the triple-expansion type, steam being supplied by three cylindrical boilers fitted with Howden's forced draught, have been constructed by Messrs. Caillard of Havre.

Oceania.—On November 6th, the steamship *Oceania* (of which we gave particulars in our October issue, page 117), built to the order of Messrs. Fratelli Cosulich, of Trieste, by Messrs. Alex. Stephen & Sons, Ltd., Linthouse, ran her trials in the Firth, which were successful in every way, the machinery running without a hitch, and the vessel, though carrying more deadweight than had been intended for the trial trip, fully attained the desired speed. The owners were represented at the trial by Mr. Augusto Cosulich, and the builders by Mr. A. E. Stephen and Mr. F. J. Stephen. The whole of the non-conducting coverings on this vessel have been supplied and fitted by Messrs. Matthew Keenan and Co., Ltd., of Armagh Works, Bow.

Selja.—On November 8th, the new steamer *Selja* (of which we gave particulars in our November issue, page 155) proceeded to sea for her trial trip. She is a handsome steel screw steamer and has been built by Messrs. Wm. Gray and Co., Ltd., to the order of Mr. Wilhelm Jebsen of Bergen. The vessel attained a speed of 11½ knots, and the behaviour of both ship and machinery was in all respects satisfactory. The *Selja* afterwards proceeded to Cardiff to load. Messrs. S. T. Taylor & Sons, of Scotswood-on-Tyne, have covered boilers, pipes, etc., of the vessel with their "Tynos" non-conducting material.

Ardanmhor.—On November 14th, the large steel screw cargo steamer *Ardanmhor* (of which we gave particulars in our November issue, page 156), built by Messrs. David and William Henderson & Co., Ltd., Partick, to the order of Messrs. Clark & Service, Glasgow, underwent a successful trial trip on the Firth of Clyde, when a mean speed of 1... knots was easily attained on the measured mile. During the trials everything worked well and to the satisfaction of owners and builders. Messrs. S. T. Taylor & Sons, Scotswood-on-Tyne, have covered tank and condenser of this vessel with their "Tynos" patent removable asbestos mattresses.

Ibo.—On November 15th, the fine steel screw passenger and cargo steamer *Ibo* (of which we give particulars in this issue), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyard, Middlesbrough, to the order of Messrs. Empreza National de Navigacao, of Lisbon, proceeded to sea for her official trials, which passed off most successfully, and the vessel proceeded direct to Lisbon under the command of Captain Mouvel Maria Feito. The vessel and her engines have been constructed under the superintendence of Mr. F. C. Laws, of Liverpool, the owners' representative in England. Messrs. R. T. Bruce & Co., of Hull, have coated the bottom of this vessel, with their "Nomos" composition, also the *E hunga*, belonging to the same owners.

Thimbleby. On November 21st, Messrs. Osbourne, Graham and Co., of Hylton, Sunderland, sent to sea for her official trial the steel screw steamer *Thimbleby* (of which we gave particulars in our November issue, page 156), built to the order of Messrs. Furness, Withy & Co., Ltd. Her machinery has been fitted by Messrs. MacColl & Pollock, of Sunderland, and during the trial developed an average speed of 10 knots loaded.

Harport. On November 22nd, the new screw steamer *Harport* (of which we gave particulars in our November issue, page 155), built by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of Messrs. J. & C. Harrison, Ltd., London, was taken to sea on her official trial trip fully laden. The trial was in every way satisfactory to all concerned, and the vessel afterwards proceeded on her voyage to Venice under the command of Captain Holman.

Steam Towing Launch "Lautaro."—This vessel, built by Mr. Edward Hayes, of Stony Stratford, has had a very successful trial trip; she made about three miles over the promised speed and ran most smoothly, making little wave. She was to make not less than 11 miles, but she made about 14; steam pressure 120 lbs. was easily maintained, vacuum 26 inches, revolutions 280 per minute. The vessel is 55 ft. 6 in. long, 10 ft. 0 in. wide, draught about 4 ft., specially designed for work in Chili to carry Customs officials, and towing connected with same duty. Hull built of special mild steel in four strakes varying in thickness from $\frac{1}{4}$ in. to $\frac{3}{16}$ in. bare, the frames are of angle steel 2 in.

Steam Towing Launch *Lautaro*.

by 2 in. on the bulkheads, $1\frac{3}{4}$ in. elsewhere, spaced 15 in. centre to centre; four steel bulkheads are fitted, forming five compartments; these are stiffened with strong steel and fitted with manholes, brass sluice doors, etc.; forward of the collision bulkhead the space is given to anchor chain locker only, next to this is placed the saloon, having seats and backs upholstered in blue with teak edgings, a large folding teak table, lockers, cupboards, four brass scuttle lights, shelves, mirror, large four frame skylight of teak highly finished with green figured glass and brass protection rods, also a steam-heated water boiler, which boils water in a very short space of time by simply opening a valve in the cabin; the steam comes direct from the main boiler; this boiler is of copper and is clean and noiseless. Aft of the saloon on the port side is the lavatory, and on the starboard side is the stairway leading from deck through a polished teak companion and folding doors into the saloon. Next comes the machinery space placed between steel bulkheads. The boiler is one of the marine return tube type of special size and design, as supplied in these boats for working in tropical climates; the working pressure is 120 lbs. per square inch, and it has been built under Lloyd's survey; cool air is brought to the furnace by two large cowls, a teak engine-room skylight and the stokehold grating which is of steel, and the hot air over the boiler is extracted by a special formation of steel casing, thus giving a natural draught of great efficiency. The main engine is a Hayes compound surface-condensing double-balanced crank type, having cylinders 8 in. and 16 in. diameter and a common stroke of 10 in., all wearing surfaces are of extra size and automatically lubricated and the whole engine designed for continuous hard work at full speed; the condenser has a very large cooling surface, as the circulating water is of high temperature in Chili, air-circulating, feed, and bilge pumps are fitted on the port side of the engine, and are worked off the low-pressure engine by long rocking levers; these engines work most smoothly and with little vibration even at highest speed. The screw shafting is of Siemens-Martin mild steel in two pieces with solid couplings; the thrust bearing has seven rings and is of horseshoe type running in an oil bath; plummer blocks are also fitted; the stern tube is lined with white metal for a long distance at both ends and fitted with an internal brass gland; the propeller is of special towing type, having three blades, and is of hard-grained cast iron. A powerful fire and salvage pump is fitted in the engine-room, with instantaneous deck connections for suction and delivery hose; a supplementary steam-boiler feed pump is also fitted to the end of the coal bunkers in the machinery space, and a steam bilge ejector of the usual type. The aft cabin for the crew is fitted with seats suitable for bunks, a table, lockers and a steam-heated cooking apparatus heated with steam from the main boiler. A canvas awning extends almost the entire length of the vessel, and is supported by galvanized handrail and stanchons, and there is also a powerful patent sliphook with disconnecting gear, towing bow, large teak shelter for the Customs officials, and steering wheel of brass-bound teak on weather-proof standard. A small winch is fitted forward for raising the anchor, which is of the folding type.

Stein and Alice.—On October 31st, the new steamer *Stein* ran trials on the Firth of Clyde. The vessel, which has been built by Messrs. Bow, M'Lachlan & Co. (Limited), Paisley, under the superintendence of Messrs. Muir, Tilston & Co., Glasgow, is of single-screw type, and is intended for special service on the River Plate as a steam tender. After the trials were satisfactorily completed, the steamer went into the Albert Harbour, Greenock, to load for the voyage to Buenos Ayres. Another new steamer, the *Alice*, built by Messrs. Bow, M'Lachlan & Co. has also completed her trials. This vessel was built to the order of Messrs. Douglas and Younger, of London, for transport service on the West Coast of Africa.

Pine.—The new steamer *Pine*, built by Messrs. John Fullerton & Co., Paisley, and engined by Messrs. Renfrew Brothers & Co., Irvine, for Messrs. Joseph Fisher & Sons, Newry, has attained a mean speed of 11 knots on trial. The *Pine* is the twenty first vessel built by Messrs. Fullerton for the same owners. She has a carrying capacity of 400 tons.

Dick.—On November 6th, the new steel screw tug *Dick*, built by Messrs. John Fullerton & Co., Paisley, and engined by Messrs. M'Kie & Baxter, Govan, ran trials on the Clyde. The vessel has been built for Buenos Ayres owners through Messrs. Houlder Bros. & Co. (Limited), under the superintendence of Messrs. Flannery & Given, Liverpool and London, and to Lloyd's requirements. The trials were quite satisfactory, the vessel attaining a speed of $9\frac{1}{2}$ knots on the measured mile at Skelmorlie.

Moyle.—On November 7th, the steel screw steamer *Moyle*, built and engined by the Ailsa Shipbuilding Company, Troon, completed a series of exhaustive high speed and progressive trials. The vessel was in a fully loaded condition and the results were very satisfactory, a speed of $11\frac{1}{2}$ knots being attained on the measured mile at Skelmorlie.

William Strong.—On November 18th, the trials of the hopper steamer *William Strong*, launched recently by Messrs. Fleming & Ferguson, Paisley, for the Melbourne Harbour Trust, which have just been carried out, were in every way satisfactory. Immediately after the trials the vessel sailed for Melbourne.

PARAGRAPHS.

The City (late Leask's) Engineering Academy, at the last examination for extra first class engineers in London, recorded three out of the total [illegible] successes. This institution certainly maintains uninterrupted record of success, not only in this grade, but in all examinations undertaken by them.

An order for a 55 ft. steel cabin motor launch has been placed with Mr. James A. Smith, M.I.N.A., by a large firm of shipbuilders in the north. The launch is for the firm's own use, and is to be designed on yacht lines and finished in a high-class manner. She will have a Gardner motor of 80 h.p.

Engineering Amalgamation.—The amalgamation is announced of the engineering firms, Applebys, Limited, and the Temperley Transporter Company. These firms are well known as manufactnrers of eranes and transporting machinery of every description, specializing in shipyard, dock and harbour equipments, steel works, coal handling and contractors' plant. The amalgamated firms will trade under the title of Applebys, Limited, with offices at 58, Victoria Street, Westminster, and works at Glasgow and Leicester.

The meetings of the Institute of Marine Engineers for December are as follows:—December 2nd: Discussion on Mr. A. E. Battle's paper "Ventilation." December 5th: Bohemian Concert, arranged by Mr. J. F. Redman (Member of Council). December 9th: Lecture by Mr. T. F. Aukland. December 16th: Discussion on Mr. Robt. Elliott's papers: "Damage to Hulls and Machinery." December 31st: New Year's Eve social gathering of the Junior Sections, arranged by Messrs. Hawthorn and Lang (Conveners Junior Section).

Ivy.—The Southern Nigeria composite twin-serew steam yacht *Ivy* of the following dimensions:—length, 220 ft.; breadth, 34 ft.; depth, 16 ft.; tonnage, Thames measurement, 1131, returned to England after ten years' commission on the West Coast of Africa on the 4th June, 1907, with orders for an extensive overhaul and refit. For this purpose she was placed in the hands of Messrs. J. S. White & Company, Ltd., of East Cowes, Isle of Wight, with instructions for a general and thorough overhaul. It was essential that the vessel should return to her station with the utmost expedition, and the contractors have met this contingency with the complete approbation of the Crown Agents for the Colonies, the Nigerian Director of Marine, Lieut. Child, and her eommander, H. G. Moore, R.N.R., the vessel having been completed and despatched on her return journey on the 9th November. The consulting engineers for the work were Messrs. Ridsdale, Wells & Kemp, consulting and inspecting naval architects and marine engineers to the Crown Agents for the Colonies. The extent of the refit was of a very thorough character, eomprising the following work:—New boilers have been fitted, propelling machinery and auxiliaries removed from the vessel and thoroughly overhauled; new electric light machinery and entire new electric installation has been fitted. The whole of the internal fittings, cabins, store-rooms and ceilings throughout, upholstery work, electroplated work, boats, masts and rigging have been removed. The vessel has been thoroughly overhauled from stem to stern: new masts and rigging fitted, new boats supplied and fitted, governor's quarters rearranged and enlarged, new boat-deck fitted fore and aft, new flying bridge with steering gear, compasses, telegraphs, semaphores, supplied and fitted, new deck auxiliary machinery, windlass, and anchors supplied and fitted, new refrigerating machinery and cold chambers brought up to date, new awnings and canvas gear supplied and fitted, new upholstery work and bedding supplied and fitted, the vessel's bottom recoppered, hull and all decks caulked and paved, the vessel scurfed, cleaned out, repainted, repolished and redecorated throughout, all plumbing thoroughly overhauled and renewed. In short, the vessel has had a thorough, complete and extensive overhaul. Commander Moore, R.N.R., has remained by the ship the whole of the time and rendered valuable assistance during the carrying out of the work. The black crew, to the number of 60, have been lodged ashore. The vessel went out for a trial trip on the 28th October, when the machinery, steering gear and windlass were all thoroughly tested. The vessel was put on the measured mile for a series of runs, when a speed of 13 knots was attained. Lieut. Herbert A. Child, R.N., Director of Marines, Southern Nigeria, and Mr. T. H. Wells, Engineer to the Crown Agents for the Colonies, expressed themselves as being very pleased with the results. The electric light, which includes a powerful searchlight, was thoroughly tested after dark in the presence of Lieut. Child, R.N., Mr. T. H. Wells, consulting engineer and Commander Moore, R.N.R., with satisfactory results.

BOARD OF TRADE EXAMINATIONS.

Extra First Class

1907		
Oct 19th	Briggs, H W	Ex 1C Glasgow
,, 26th	Congdon Wm J. ..	Ex 1C Liverpool
,, 26th	Forsyth Rg J.	Ex 1C Liverpool
Oct. 19th	Hall, John B	Ex 1C N.Shields
,, 19th	Heck, William	Ex 1C N.Shields
,, 19th	Howell, William ..	Ex 1C London
,, 19th	Key, John F.	Ex 1C London
,, 19th	Low, James G.	Ex 1C London
,, 26th	Maitland, John	Ex 1C Liverpool
,, 19th	Pawley, Robt J. ..	Ex 1C Cardiff
,, 19th	Pearse, Percy H. ..	Ex 1C London
,, 26th	Pugh, William	Ex 1C Liverpool
,, 19th	Rees, David J	Ex 1C N Shields
,, 19th	Rielly, Peter	Ex 1C Glasgow
,, 19th	Stirling Andrew G. ..	Ex 1C N Shields
,, 26th	Twiby, Ernest	Ex 1C Liverpool
,, 19th	Wengi, Louis B. ..	Ex 1C London
,, 19th	Willis, J W. J.	Ex 1C Liverpool

NOTE—1C denotes First Class; 2C Second Class.

October 12th, 1907.

Bain, Reg. A...	1C	N Shields
Barelay, Wm...	1C	Greenock
Castling, R H	2C	N Shields
Derricks, F J	1C	N Shields
Dodd, Edwd. C	1C	Liverpool
Esplin, George	1C	Dundee
Evans, Wm. H	2C	London
Fairweather, J.H	1C	Dundee
Farrow, Joseph	1C	Liverpool
Griffiths, Henry	1C	N.Shields
Henry, M. R	2C	Greenock
Humphries, W	1C	Liverpool
Kelly, D. A ..	1C	Hull
Lake, Geo H.	2C	Hull
Magrath, C. J C	2C	Hull
M'Lean, David	1C	Greenock
Morrison, R W.	2C	Liverpool
Nelson, John W.	2C	N.Shields
Parry, Arthur J.	1C	Liverpool
Peck, Wm. W.	2C	Liverpool
Pierce, Reg G	1C	London
Redford, J. W.	2C	Hull
Shean, Syd. E.	1C	London
Taylor, Henri..	1C	N Shields
Walton, S.	2C	Hull
Willoughby, J.H	2C	London
Wilson, Alex. H.	2C	N Shields
Young, Geo G.	2C	London
Irvine, James ..	1C	Glasgow
Jessop, William	1C	N Shields
Lewis, John....	2C	W Hart'l
Lindsay, A C.	1C	South'ton
Macdonald, C.	1C	Glasgow
Macmaster, A.	1C	Glasgow
M'Donnell, S ..	2C	Barrow
Mills, Chas.....	2C	Leith
M'Innes, John	1C	South'ton
M'Lay, Jas B	1C	London
Monks, John ..	1C	Liverpool
Morris, Thos ..	2C	Cardiff
Norris, Edgar G.	1C	Cardiff
Orchard, Ernest	1C	Cardiff
Philip, W J. ..	2C	London
Rees, John	2C	Cardiff
Russell, W H	1C	W. Hart'l
Sandell, V. J. L.	1C	Liverpool
Thomas, Edwd.	2C	Liverpool
Tickell, Wm. J.	2C	South'ton
Todd, George ..	1C	Liverpool
Tucker, J. H. ..	2C	Cardiff
Turner, Thos. J	1C	London
Wallis Thos A.	2C	Barrow
Wilson H G ..	2C	W. Hart'l

October 19th.

Adamson, W. D.	2C	South'ton
Andersen, W. A.	1C	W. Hart'l
Andrews, H. T.	1C	Cardiff
Appleby F.....	2C	W. Hart'l
Armstrong, M. S D	2C	Leith
Arrowsmith, F.V	2C	Liverpool
Ashworth, E. ..	1C	N.Shields
Atkinson, J. S.	1C	W. Hart'l
Bald, John	1C	Glasgow
Blackie R G...	2C	Plymouth
Carnaby, J. W	1C	N Shields
Cassie, Josh. M	1C	London
Claireaux, A. J.	2C	Leith
Cockburn, R L.	1C	Leith
Crompton, W H.	1C	London
Dunlop, W G.	1C	Barrow
Eccleston, R A	1C	Liverpool
Erickson, L M	2C	N Shields
Evans, Lewis R	2C	N Shields
Fitt, Wm H. ..	1C	Cardiff
Flood-Jackson, M	2C	Liverpool
Forbes, Robt.	2C	Liverpool
Gilroy, Wm ..	2C	Leith
Guthrie, Wm...	1C	Glasgow
Gyte, Douglas..	2C	Liverpool
Harold, Chas F	2C	N Shields
Hire, Benj G.	1C	Cardiff
Holmes A G	1C	Cardiff
Hope, Thos W.	1C	W Hart'l
Hopkins, T A	2C	London
Horrocks, W B.	1C	Liverpool
Houston H V	2C	Cardiff

October 26th.

Allan, James R.	2C	Greenock
Alsop, D T. ..	1C	Sunderl'd
Berry, Arch. J.	2C	Liverpool
Blanchard, E. W. H	2C	London
Brackenbury, Jas. W.	1C	Hull
Brown, Hugh ..	1C	Greenock
Campbell, A. N.	1C	London
Collie, A W. A.	1C	Aberdeen
Cowan, Wm.W	1C	N.Shields
Davey, Frank ..	2C	Liverpool
Davies, Evan T.	2C	Liverpool
Davison, G. S.	2C	Sunderl'd
Dilworth-Harrison, D. R.	1C	N.Shields
Haig, H. G. C	1C	Liverpool
Hart, Robt. R	2C	Aberdeen
Harwood, W F.	1C	Liverpool
Jones, David F	2C	Liverpool
Jones, John L..	2C	London
Knox, Alfred G.	2C	Hull
Landreth, Con	1C	N.Shields
M'Arthur, Arch.	1C	Greenock
McKay, John ..	2C	London
Moffitt, T. E ..	2C	Sunderl'd
Montgomery, Geo. R.	1C	Liverpool
Muggleton, R. C. N.	2C	London
Nelson, Samuel	2C	Greenock
Newton, William	2C	Aberdeen
Porter, Thos. A	2C	Liverpool
Quarmby, R A.	2C	Hull
Reid, John	1C	N.Shields
Reed, Arthur ..	2C	London
Robinson, Geo.	1C	Hull
Shotton, J W.	2C	N.Shields

The Marine Engineer
And Naval Architect.
LONDON, JANUARY 1, 1908.

THE NAVY AND THE MERCANTILE MARINE.

THE First Lord of the Admiralty, speaking at a dinner of the Liverpool Shipbrokers' Benevolent Society on December 14 last, made reference to the relations existing between the Navy and the merchant service; and the subject is topical and timely, because it cannot be doubted that a considerable change has taken place in regard to this matter in recent years. It is only necessary to turn back to the papers and speeches dealing with the subject but a short time ago, and to compare these with the state of affairs as they are, to realize the truth of this statement. The aim and object then was to enable the resources of the mercantile marine to be promptly rendered available by forethought and careful organization for the purpose of defence. That this is still the purpose goes without saying; it is in regard to the measures to be taken that a difference of opinion and plan has been manifest. The idea was, as regards the merchant seamen, by giving them an annual retainer and some training to create a reserve for the Navy. Similarly, by means of bounties, it was proposed to create from the mercantile marine a fleet of unarmoured vessels which might protect our valuable commerce in the event of war. Lord Tweedmouth said on the occasion we refer to that perhaps the mercantile marine thought the Admiralty was not quite as sympathetic with them as they ought to be; but this was not the case. The Admiralty thoroughly recognised the merits of the mercantile marine, and were anxious to have the help of the excellent officers and men who served in the merchant ships. There was this, however, to be recognised, that in the event of emergency it would not be possible to take away the officers and men of the mercantile marine from that service, because if we were at war they would be wanted to continue their own work upon the seas. The fact is, of course, that it has now been recognised that the ships of the Navy must be always ready, and the men to man them must be prepared to go on board at an hour or two's notice. The new mobilizing arrangements permit every ship that is ready for sea to be manned from the cadres of the regular service, and the Reserve has become a reserve to fill up the waste of war. The reason why the Royal Naval Reserve is not called upon now on mobilization is that, as Lord Tweedmouth explained, an immense number could not respond because they are scattered in all parts of the world While, therefore, he repeated that the Admiralty looked upon this fine force with the greatest admiration and enthusiasm, the method in which it is proposed to utilize the Reserve is not that which was originally intended; it assumes, indeed, that the officers and men of the merchant service will be employed in their own ships, either in bringing supplies to this country or as auxiliaries to the fleet.

This brings us to the second part of our subject. Speaking of the *Mauretania* and the *Lusitania*, Lord Tweedmouth said that he was only too thankful that these two ships were closely connected with the British Navy. He hoped they would never have to call upon the Cunard Company to hand over their ships in time of war, but he was quite sure if they had to do so that the Admiralty would get good value for their money. The First Lord suggested that these vessels might be used as scouts, or possibly to do a certain amount of protective work to other ships which might wish to be convoyed, and for this purpose their superior speed and armament thoroughly fitted them. This is in a measure the original idea of the use to which the ships of the merchant marine might be put in time of war. It was conceded that merchant steamers would be inferior to ships specially designed for the Navy, the inferiority being both in offensive and defensive strength. But at the same time, as it was assumed that our commerce would be assailed by merchant vessels converted into cruisers, similar vessels, if swifter and more powerful than the hostile sea wolves, might act as protectors to a convoy of their weaker sisters. There has not been in the recent wars by sea any experience from which lessons might be drawn in this connection. It is true that both in the war between the United States and Spain and that between Japan and Russia all four Powers drew to a certain extent upon their mercantile marine for auxiliaries to the navy. But the ships were not used for the protection of commerce, and it is indeed more likely that in the other rôle mentioned by the First Lord, that of scouts, that the big ocean fliers would prove their value. In other respects, however, it was, in the cases we have mentioned, that the ships of the mercantile marine were shown to be of the greatest assistance. They were drawn upon for a number of auxiliary services, and where preparation had been made in the way of fitting it was found that they could be speedily converted to most valuable purposes. This lesson has been taken to heart by the Admiralty, and thus we are able to point to the beginning of an invaluable auxiliary fleet, drawn almost entirely from the mercantile marine, and capable of being quickly extended to almost any amount from the same source. Mercantile auxiliaries, as Lord Selborne once pointed out, fall into two categories—those which by the encouragement of the Admiralty may be so built as to be useful for naval purposes, and yet remain doing the work and earning money for their owners; the second category consists of those which must be specially fitted up in peace time and taken over for peace purposes, there to serve as models for others to be similarly equipped should emergency arise. In the first category we have the

Mauretania and *Lusitania*, the nucleus, it may be hoped, of a larger fleet of similar vessels. And in the same category are the colliers, which, when not employed in the service of the fleet, for the requirements of which they have been specially equipped, can find other employment outside that duty. It was British colliers to a very large extent that served Rodjestvensky in his ill-fated voyage to the Far East, and it is British colliers again that will furnish the greater part of the coal for the American armada under Admiral Robley D. Evans in its long voyage from the Atlantic to the Pacific.

Turning to the other class of ships, Lord Tweedmouth reminded his audience that nowadays every large fleet in the Navy is accompanied by a repair ship, the business of which is to take in hand those defects which cannot be easily made good on board the men-of-war themselves. The *Tyne*, the *Assistance* and the *Cyclops* are three vessels of this description, originally merchantmen converted to their present use. The displacement of the great *Cyclops*, 11,300 tons, and her most comprehensive equipment for repairs of all kinds, are indications of the value of her smaller predecessors and the belief of the naval authorities in the usefulness of such floating dockyards. It took many months to convert the *Indiabarah* into the *Cyclops*, and therefore it is not probable that it will be left for an outbreak of war to furnish her with sisters; but at the same time all the repair ships will not need to be so completely equipped as she is, and this is certainly one sphere in which merchant ships will be found useful. Then there is the *Aquarius*, a distilling vessel, originally the *Hampstead*, launched at Sunderland in 1902. It was thought at one time that obsolete men-of-war might be converted to this use, but experience has proved that here again we must call upon the merchant navy to supply suitable vessels. Hospital ships, mine-layers, sea-going depôts for the destroyers, despatch vessels, supply ships and oil carriers—these are all adjuncts to the Navy which will probably be better supplied from the mercantile marine, and which it will certainly be more economical not to build out of the Navy Estimates.

Institution of Engineers and Shipbuilders in Scotland, Glasgow.—The Fourth General Meeting of the Session will be held on Tuesday, January 21st, and the "James Watt" Dinner on Friday, January 17th.

The Electric and Ordnance Accessories Company, Ltd.—We have received a recently published catalogue issued by the above firm dealing with the "Stellite" Electric Heaters, in which no less than fifty different patterns are illustrated. In these devices two systems of heating are employed, *viz.*: The "Rivers" system, in which a large number of heating units working at a low temperature are employed; the "Eclipse" system in which fewer units working at a medium temperature are used. In both systems the heat is accomplished by convection, the heaters being so arranged that there is an induced draught of air entering at the bottom of the heater, which passes over and through the heating units, and issues from the top at a considerably higher temperature. Great uniformity of temperature is attained, as all the air in a room is in a very short time rapidly passed many times through the heater.

SHIPBUILDING BERTHS AND CRANE EQUIPMENT.

THE past few years have seen great advances made in labour-saving appliances and means by which transport can be easily and expeditiously carried out. As an example of this we have much pleasure in illustrating an equipment which has recently been constructed for the shipbuilding yard of Messrs. William Beardmore & Co., Ltd., at Dalmuir, N.B.

The first feature of the equipment is illustrated in Fig. 1, and consists of a combination of overhead travelling cranes with side walking cranes, by means of which shipbuilding material can be most quickly and easily manipulated, the cranes being used either

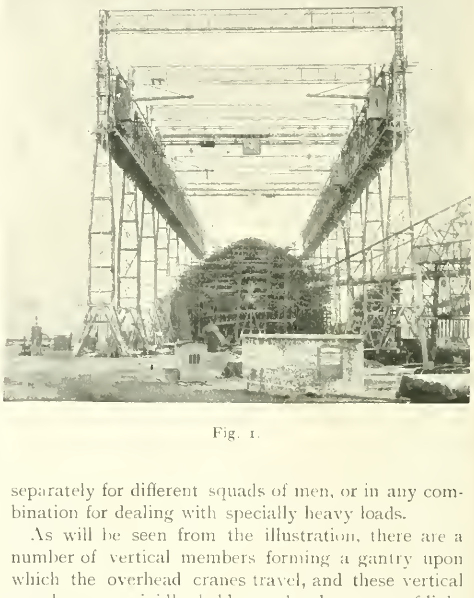


Fig. 1.

separately for different squads of men, or in any combination for dealing with specially heavy loads.

As will be seen from the illustration, there are a number of vertical members forming a gantry upon which the overhead cranes travel, and these vertical members are rigidly held together by means of light cross girders overhead, the travellers running underneath same and commanding the whole area of the slips. The vertical members also carry rails or channels on which two or other number of ordinary walking cranes can run. These cranes are arranged at either side of the structure, and are so fitted that their jibs can be swung round over a vessel under construction or to the side thereof.

This arrangement has been found to satisfy all the requirements dictated by experience, and enables the material to be handled with the minimum delay,

whereby the fitters or platers are regularly supplied with such material as and when required; the number of cranes employed also enables an equivalent number of squads of fitters or platers to be continuously and efficiently employed, each crane being able to traverse the whole distance of the berth with its load. Furthermore, two or more cranes may be brought to bear upon any exceptional load.

The lattice girders which connect together, at the top, the vertical members, thus preserving the gauge of the crane gantry, may, if desired, be replaced by roof principals at a somewhat increased cost, and they can be roofed in with glass or other material, so that complete protection is afforded in all weathers during construction, and work can be proceeded with uninterruptedly.

The overhead travellers are electrically driven, and are proportioned for a working load of 15 tons, the span being 108 feet and the total length of gantry 750

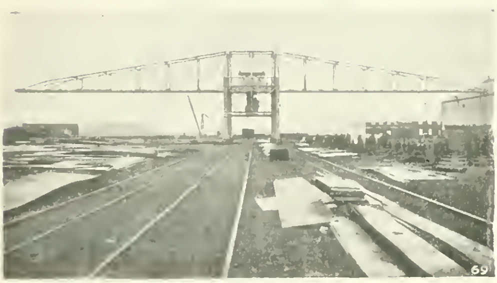


Fig 2

feet. The walking cranes are also electrically driven, and are four in number, two on each side of the gantry, each commanding an area of 30 feet radius.

The overhead travelling cranes have a vertical lifting range of 140 feet, and three motions, *viz.*: lifting, travelling and traversing, each operated by separate motors arranged to run on a 440-volt circuit. These motors are series wound, the lifting motor giving 50-b.h.p., running at 500-r.p.m., the travelling motor 30-b.h.p., running at 500-r.p.m., and the traversing motor 10-b.h.p., running at about 600-r.p.m. The speeds attainable are as follows, *viz.*:

Lifting,	with	full	load,	about	40	feet per minute
,,	,,	no	,,	,,	100	,, ,,
Travelling	,,	full	,,	,,	500	,, ,,
,,	,,	no	,,	,,	750	,, ,,
Traversing	,,	full	,,	,,	220	,, ,,
,,	,,	no	,,	,,	350	,, ,,

The walking cranes are constructed for a lifting load of five tons at a radius of 30 feet, to run on a single rail, the height between same and the overhead guides being 24 feet. These cranes have a wheel-base of 20 feet and a lifting range of 125 feet.

Each crane is provided with three motors, for lifting, travelling and slewing respectively, arranged to run on a 440-volt circuit. The lifting motor gives 30-b.h.p., running at about 500-r.p.m., the travelling motor 20-b.h.p., running at about 600-r.p.m., and the slewing motor 5-b.h.p., running at about 600-r.p.m. The speeds attainable are as follows:—

Lifting,	with	full	load,	about	60	feet per minute
,,	,,	no	,,	,,	150	,, ,,
Travelling	,,	full	,,	,,	250	,, ,,
,,	,,	no	,,	,,	450	,, ,,
Slewing	,,	any	,,	,,	300	,, ,,

The cranes were tested with an overload of 50 per cent. The operator's house is attached to the vertical frame as shown. Extra special flexible steel-wire rope, 2-inch circumference, with an aggregate breaking strain of $33\frac{1}{2}$ tons, arranged in two parts, winding one part, is employed for lifting.

The 5-ton electric cantilever crane, illustrated in Fig. 2, has been specially constructed for handling plates.

The total range of traverse is 240 feet, and the clear height of lift above rail level is 22 feet; the crane runs on a double line of rails 25 feet between centres, affording a wheel-base of 52 feet 3 inches. The horizontal girder or beam is of the lightest possible construction, specially designed with a view to avoiding wind pressure, and is fixed upon an under-carriage or structure of best mild steel plates, steel angles and rolled sections, all riveted together and well braced; this under-carriage is mounted upon eight wheels, four of which are connected by means of gearing on one side of the crane, and they swivel in a vertical plane so that they will all bear evenly on the rails.

The crane is provided with three motions, worked electrically, namely, lifting, travelling and traversing. In the case of the lifting and traversing motions the same motor is used, and so arranged that each motion can be performed singly, but not simultaneously; the travelling motion is operated by means of a separate motor, and all are served by a current of 440 volts.

The motors are of Messrs. Vickers, Sons & Maxim's make, series wound, reversible, enclosed ventilated type, and are of the following powers and speeds, *viz.*:

Lifting and traversing 50 b.h.p. running at 500 r.p.m.
Travelling ... ,, ,, ,,

They are rated for one hour's continuous running at full load, with 75 degrees Fahr. rise in temperature.

The speeds provided for are as follows:

Lifting,	full load ...	about	100	feet per minute.
Traversing	,,	,,	400	,, ,,
Travelling	,,	,,	300	,, ,,

Lighter loads are lifted faster in proportion than the full load, and by means of the controllers the speeds are capable of being reduced to any desired extent.

The lifting gear consists of two reductions of steel machine-cut spur gearing, and a cast-iron barrel grooved in the lathe spirally right and left, to ensure a vertical lift without surge, and also equal distribution of strains, the barrel being of sufficient capacity to take the whole of the lift-rope required without overlapping.

The traversing gear consists of two reductions of steel machine-cut spur gearing, and a cast-iron barrel also grooved in the lathe right and left hand, wire rope for both lifting and traversing being provided of ample strength.

This work has been carried out by Messrs. Applebys, Ltd., of 58, Victoria Street, Westminster, which is an amalgamation of Messrs. Jessop and Appleby Bros., and the Glasgow Electric Crane and Hoist Co., Ltd., with the Temperley Transporter Company. We understand that the above firm has just secured a contract in competition with Continental firms for a large equipment for the works of Messrs. A. F. Smulders, of Schiedam.

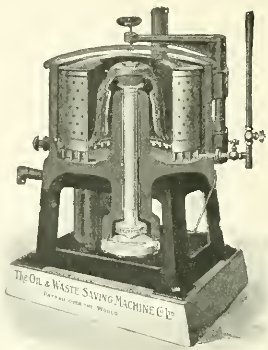
TURBINE OIL AND WASTE SAVING MACHINE.

IN the December issue, under the heading of "Bye-Products of the Engine-Room II.," we referred to a machine which was being widely adopted for the extraction of the oil from the soft materials used in handling it, and the various elements in the modern steamship were epitomized from which a saving might be gleaned. Sufficient interest has been aroused to warrant a fuller description, and we have much pleasure in giving further particulars illustrated by a sectional view of the appliance.

The body of the machine consists of a cast-iron base with a cylindrical receptacle above, open at the top, into which is fitted a light steel basket having perforated walls, leaving a free annular space between its wall and the cylindrical casing. This basket is fastened to the extension base of the central perforated dome, which is supported by means of a vertical spindle resting in a footstep bearing at the base of the machine and guided by three ball-races fitted around the spindle, the whole being free to revolve.

To the base of the dome a single ring of turbine blades is fitted, steam to which is supplied from the small pipe with nozzle on the right. The steam passing through the blades exhausts into the central perforated dome, thence through the perforations into the steel basket, in which is placed a galvanized wire removable basket, containing the waste or other material to be treated: the steam permeates the material and lowers the viscosity of the greasy matter, so that the drum, caused to revolve by the steam impinging on the turbine blades, whirls the thinned oil by centrifugal action through the perforations of the steel basket into the annular space surrounding it, accompanied by the exhausting steam which escapes to the atmosphere by the exhaust pipe behind. The oil drains off through the hole in the base, on the left, into any convenient vessel, whence it can be cooled and filtered.

When the oil has ceased to flow, steam is turned off, the revolving basket stopped, and the material removed, which is there ready for use again.



The extremely compact nature of this self-contained separator, together with the small amount of attention required, make it particularly suitable for shipboard, and although only the larger liners use sufficient material to allow of an individual apparatus, yet, as mentioned in the previous article, the economical running of a regular fleet centred at one port may well be influenced by the installation of such a machine.

This machine is being placed upon the market by the Oil and Waste Saving Machine Co., Ltd., through their sole agent, Mr. Jean Schmidt, 20, High Holborn, London, W.C., whose booklet, "Key to Economy," giving the names of many hundreds of users of the machine in all parts of the civilized world, seems ample evidence of its popularity.

Hunt "Industrial" Railway Equipment.—We have received a catalogue of the Hunt "Industrial" Railway, which is manufactured by the C. W. Hunt Co., of Staten Island, New York, and sold by Messrs. Murray, Lotz & Co., of 102, Fenchurch Street, London, E.C. This catalogue includes complete description and illustration relative to every element for a railway equipment for a works, and the particulars are given in such a way as to enable an intelligent person who knows what he wants to detail his order to the manufacturers without the slightest difficulty. The various devices illustrated are not only extremely ingenious, but their constructive details lend a distinctive useful character to them, indicating an intimate knowledge as to the points of ordinary everyday use.

For want of space we are compelled to hold over "The Screw Propeller," "Electricity on Board Ship," "Reviews," and other articles until our next issue.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

The Egyptian Mail Steamship Company despatched their first steamer, the *Heliopolis*, from the Clyde on Thursday, the 28th November, 1907. As she called at Plymouth to embark the bulk of those of her passengers who were going by the long sea route instead of proceeding overland to Marseilles, advantage was taken to combine the advantages of a trial trip with the first stage of the maiden voyage. So a number of guests left St. Pancras at midnight on the Wednesday and travelled to Greenock breakfasting in great comfort in a restaurant car, which was added to the train at Carlisle, and thus having no annoyance from the fact that it was nearly eleven in the forenoon before the train journey was completed. A tender at once took us out to the *Heliopolis*, which was lying out in the Clyde. A striking looking craft she is, with her two pole masts and her big funnels, which seem to be set at a rake which is as unusual nowadays as it is refreshing to the old-fashioned eye. As we came alongside the liner, one was struck with the fineness of her lines and the remarkable flare which she is given forward. The effect of this flare is perhaps somewhat accentuated by the comparative shortness of her forecastle. But, however that may be, the whole appearance of the vessel seems to give one an idea of speed. Speed she undoubtedly has, as we soon learnt when the anchor was weighed and we passed down to the open, and not too calm, sea. A long day was then spent in examining the characteristics of the ship, which is certainly sumptuously fitted up. Perhaps the first room to be studied was the Ritz Café, on the boat deck, where lunch was served in order that we might be afforded some idea of the capacity of the chefs and of the special kitchen which adjoins the apartment. This apartment is panelled in oak, and furnished in the style of Louis XV., the guests being, of course, accommodated in small parties at separate tables. Our subsequent meals were served in the main saloon on the shelter deck—a room which is the full width of the ship. Its decoration is certainly most tasteful, being carried out in simple white, without a single suggestion of any gilding. Relief is, however, afforded to the eye by rose pink curtains, carpets and seats. There are down the sides of the saloon various partitions which make for partial privacy, and these, being pierced with circular openings, allow refreshing glimpses of the rose pink hangings. The main staircase is effective, being carried out in dark brown teak, but at the same time is noticeable from the fact that some economy of space has been practised here. This is a distinct point in its favour, since in some recent ships there has been great waste of space in stairway and landings. Adjoining the companion an electric lift is fitted for the use of passengers. It connects five decks. The music-room is a striking apartment, its centre being over the dining-saloon shaft, and having a large and beautifully designed jardinière within the balcony rails. Here again the woodwork is white, but the upholstery is pastel blue. There are charming corners round the fireplace. The library, again, is a handsome room, panelled in oak in the French style of the Regency. The smoke-room, on the other hand, is essentially British in its design, though also panelled in oak. Here are fitted wrought-iron lanterns as fittings for the electric light. As regards the state-rooms, these may be said to be generally large and comfortable, the evident idea of those who provide these vessels being to cater for those who are accustomed to comfort and who expect to find it when they go to sea as elsewhere. I may add that the second-class is most comfortable its public rooms being of corresponding excellence to those of the saloon. Before leaving the details of the passenger accommodation, it may be remarked that special provision has been made for the children, who have a charming nursery, well isolated from the grown-up rooms. Near it are family flats. There are also *suites de luxe* for the accommodation of the travelling millionaire.

The ships being intended for trade in a hot climate the windows throughout are large, whilst adequate ventilation is ensured by the provision of a large number of thermo-tanks, capable of renewing the whole of the air in the living part of the ship once every five minutes. Besides these there are the usual ventilating fans. The sanitary installation, is also very adequate, there being some forty-eight baths in the vessel!

Turning now to her actual construction it should be stated that she is of about 12,000 tons gross register, her length being 545 feet over all, with a beam of 60 feet 3 inches, and a depth from the shelter deck of 38 feet. In all she has seven decks, the bridge, promenade and boat decks being above that taken in calculating the depth of her hull. The steering gear—like that of most Fairfield-built ships of recent years—is that of Messrs. Brown, of Edinburgh. Ten bulkheads divide the hull, and it is noticeable that the bulkhead doors are closed by machinery actuated from the upper decks, the system of simultaneous closing recently largely adopted in certain passenger steamers not having commended itself in this case. There is a cellular double bottom throughout the length of the ship, and a Marconi installation provides at once a convenience to passengers and an aid to the navigators of the ship. To ensure safety in case of an outbreak of fire, the Clayton fire-extinguishing apparatus is fitted throughout the vessel. The machinery consists of three turbines, one high and two low-pressure, of the Parsons type. The high-pressure turbine drives the centre propeller and has a low-pressure engine on either side. The horse power of the main engines is about 18,000 with about 340 revolutions a minute, and for some hours on the voyage down the Irish Sea they were reported to be driving the ship at 21·8 knots. The sea speed, however, is likely to be from 19 to 20 knots. This will take the ship from Marseilles to Alexandria in three days. When a call is made at Naples *en route* the run from the Italian port will occupy about two days. The *Heliopolis's* sister *Cairo* is expected to join her about the 25th January, and the service in each direction will then be made a weekly one. The passage down the Irish Sea was accomplished in what was certainly a fresh breeze, and the ship showed remarkable steadiness and freedom from vibration, though there are undoubtedly limited areas where some propeller vibration is noticeable enough. In the saloon, however, and in the state-room which I occupied, it was impossible to discern any indication of the running of the machinery.

We ran into Plymouth soon after noon on Friday, the 29th, having made the run round in a time which, though doubtless satisfactory to owners and builders, was perhaps too short for some of the guests. There a Great Western special awaited us, and took us back to London some forty-three hours after out departure thence. The managers of the new line have made arrangements whereby their passengers will connect with the steamers at Marseilles under exceptionally convenient conditions, whilst at the Egyptian end they will find themselves in touch with all the organization which has been devised for the exploration of the scenery and antiquities of the famous land now brought almost to our doors. Egypt, indeed, can now be visited with far less fatigue than could the Riviera a few years ago, whilst travelling and discomfort are nowadays hardly to be mentioned in the same breath.

Ships' Names.

The Board of Trade is already beginning to use its influence—granted it under the new Merchant Shipping Act—to disallow the suggested names of ships when it considers that there would be a possibility of confusion. Thus, one of the three M's now building for the P. & O. Company is to be called the *Malwa*, though in the first instance the name of *Medina* was chosen for her. *Malwa*, it may be mentioned, was the name of a vessel of just under three thousand tons, built by Messrs. Caird for the P. & O. fleet in 1872. I understand, too, that the Ellerman Line was not permitted to call the steamship *Merionethshire*, which they purchased a few weeks ago from Messrs. Jenkins & Co.'s Shire Line, by the name of *Grecian*, and so were driven to the choice of the name *Bavarian*.

Speaking of the *Bavarian* reminds me that the ill-fated vessel of that name, so long stranded in the St. Lawrence, has been given up as a bad job and that the work of breaking her up has already commenced.

The White Star Line.

The inter-dependence of the various classes of Society is strikingly shown by the results of the financial crash in the United States. Over-speculation in that country has led to panic and disaster amongst those who deal in stocks and shraes. These people's lives would seem to be quite unconnected with those of hard-working artizans. Yet one of the first results of the collapse has been distress in

Antwerp, where, owing to the fact that the demand for luxuries from the other side has been so rudely interrupted, no less than two thousand diamond cutters have been thrown out of work. On the other hand an apparent benefit has been conferred upon the transatlantic steamship companies, for they are overwhelmed with the set of passengers towards the eastward. Some activity in this direction has been usual for some years, since large numbers of residents in the States —especially those who originate in Scandinavian countries— have been wont to make it their endeavour to spend their Christmas in the old home. The year 1907 has, however, shown a far different state of things. Rendered hopeless of doing any good for the present in the country of their adoption, large numbers of the less wealthy classes—who feel especially the pinch of lessened earnings in a country where living is so dear—are making their way back to Europe. Every line is benefiting by the effects of the movement; but the White Star Line's experience shows its effects in a remarkable way. In the second week of December their passenger liner *Adriatic* landed no less than 1750 third-class passengers at Southampton, whilst to Liverpool the Company's steamers *Cedric* and *Cymric* brought respectively another 1600 and 900 passengers of the same class, the former from New York and the latter from Boston. The total number thus works out at some 4250 persons, and the Liverpool part of the contingent alone needed some ten special trains to distribute them to their various destinations on reaching the Mersey. Since that time, however, the Cunard Company has beaten this record, the *Carmania*, *Ivernia* and *Lucania* between them bringing 5,460 passengers eastwards in a single week. Of these, some 2,204 third-class came in the *Carmania*, which thus attains a record for numbers carried.

The Hamburg-Amerika Line.

Whatever may be the foundation for the statements just published in *Le Temps*, those who follow the fortunes of the Fleets of the Mail Lines cannot fail to be interested to know of any statement about Herr Ballin, certainly one of the three most prominent personalities in the shipping world.

The journal in question states that he has fallen from the high favour in which he stood for so long with the German Emperor and that the officers who had been detached from the Imperial service to serve under him on the work of the Hamburg-Amerika Line have now ceased their activity in shipping matters. The grounds put forward for what is alleged to have happened are two. First, that he unduly pressed his rivalry against another important German shipping firm, and, second, that he was extravagant in "sumptuary matters." Both these allegations, if true, seem to be characteristic of the man. One cannot have striking genius without corresponding defects, if defects they be. Keen business men will harass their rivals in every direction, and those who play a great game are generally reckless about incidental expenses. They are surely entitled to claim that they should be judged by the whole results of their policy, not by isolated details. Finally, it may be said that the Kaiser of all people should hesitate to complain of the "sumptuary" expenditure, since so much of it went in the equipment of the steamship *Hamburg* for his own Imperial pleasure. Should the allegations of disfavour thus made have any real foundation, one can only remark that Herr Ballin, like a good many other historical personages, has learnt the truth of the old saying: "Put not your trust in Princes."

An Unfortunate Accident

has befallen one of the steamships of the Goole branch of the Lancashire and Yorkshire Railway's fleet. This is the *Frankfort*, a vessel of about 1200 tons gross register, built in 1888 by Messrs. Earle's, of Hull. She grounded in Goole Reach at the beginning of the month. Though she seems to have been floated and docked without much difficulty, the results of the grounding appear to have been serious enough, as it is reported that her back is broken and that she is practically a total loss.

But a far more serious loss has been that sustained by the Canadian Pacific Railway in the wreck on West Iron Bound Island of their fine steamship *Mount Temple*, of not far short of nine thousand tons. With something like 600 passengers aboard, and a large crew, she drove ashore in a heavy storm of snow and wind. The passengers were landed by the breeches buoy without any casualty—a fine performance enough and one that reflects the greatest credit on the discipline of the ship, but they seem to have suffered some unavoidable hardships before they were able to reach adequate shelter. Curiously enough, in this case as in so many others, misfortunes have come not singly but in whole battalions. There was the sinking of the Company's Pacific liner *Empress of China* at her dock on the other side of the continent, but a little while previous to the wreck of the *Mount Temple*. This is, though, of course, by no means a total loss, an expensive matter enough when passenger steamer are flooded. But the very day that brought the news of the *Mount Temple's* accident brought also the report of a slight mishap to another of the Company's fleet. For the *Mount Royal* was in collision with the Spanish steamer *Teodoro Larrinaga*, in the River Scheldt, whilst proceeding to Antwerp. Fortunately neither vessel in this case was seriously injured.

The Royal Commission on Shipping Freights

still drags on. Beyond providing some three respectable elderly gentlemen with an occasion to visit South Africa at the expense of the country in the autumn of 1907, it has not done much good, and seems unlikely to do any better in its future course. For the evidence adduced before it is very mixed. There are traders who come forward and complain of conferences and their rates. There are others equally representative, no doubt, who assert that their existence is highly beneficial to British trade, and an immense proportion of what is laid before the Commissioners is mere hearsay, which in no court of law would ever be allowed to be put forward as evidence at all.

Wireless Communication over Sea.—At the December meeting of the Institution of Engineers and Shipbuilders in Scotland, Mr. John Ward, President, in the chair, a paper was submitted by Mr. J. Erskine-Murray, D.Sc., on "Wireless Communication over Sea." Dealing with submarine signalling, the author stated that it was now possible to hear in a telephone on the bridge of a ship the sound of a bell rung under the water from ten to twelve miles away. Up to last July as many as 294 vessels, chiefly belonging to passenger lines on the North Atlantic, and 74 lightships had been equipped with submarine bells and apparatus for the reception of submarine signals from a distance. This method of wireless sound signalling had already proved of great assistance to navigators during foggy weather, and the fact that it was possible by its means to locate the direction of the buoy or lightship, to which the bell was attached, with very considerable accuracy, from a distance of several miles, gave it an advantage over most other signalling systems which would certainly lead to its adoption in the near future in all narrow waters where fog is of frequent occurrence. After touching on signalling by light, the author dealt with electric wireless telegraphy in its application to nautical purposes. Speaking on wireless telegraphy, he said it was practically certain it would make such rapid strides that we should in 1912 have come within measurable distance of opening up direct telephonic communication with every important city on the surface of the globe.

Worthington Pump Company, Ltd.—The extensive use of electricity has no doubt been largely responsible for the prominence which has been given to power pumps during the past few years. It has been recognised that the design of a power pump presents a problem of far greater complexity than that of a direct-acting steam pump, and that wide experience with this particular class of machinery is necessary to assure the production of a successful machine. The reasons for this are, firstly, that the speed of the plunger in any power pump is not uniform throughout the stroke, as the crank must of necessity travel in a circle, while the plunger moves in a straight line; the crank motion is therefore constant while the plunger motion is from maximum to zero. Secondly, the velocity of discharge is directly proportional to that of the plunger, therefore owing to the inelasticity of water, the plant is subjected to a series of pulsations of shocks, dependant on the speed and service which do not occur in steam pumps. As a result of their experience of over sixty years, the Worthington Pump Co., Ltd., have issued a new illustrated catalogue of the various types of power-pumping machinery manufactured by them. The illustrations are not only clear and comprehensive, but distinctly instructive, and the letterpress is thoroughly descriptive of the illustrations in the best sense of the term. The catalogue is in every way a useful addition to the office library of an engineer dealing with this class of work.

S.S. "MAURETANIA."

WE are giving in this number a page plate coloured illustration of the *Mauretania*, and also a few views of the internal fittings. The interest in the performances of the *Mauretania* and her Clyde-built sister, the *Lusitania*, has been world-wide, and it will, no doubt, continue for some time yet under the present conditions of tuning up for the best possible performance across the Atlantic to secure the premier position.

Fig. 1 is an illustration of the grand companion and

Fig. 1.
Grand Companion and Elevator Grille.

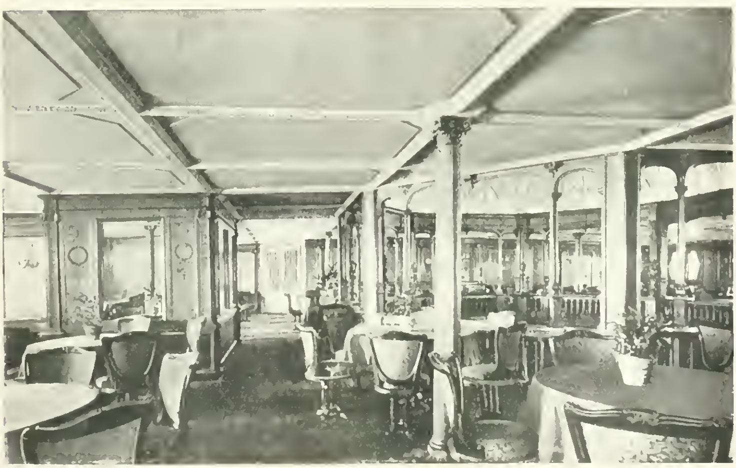


Fig 2
View in Upper Dining Saloon

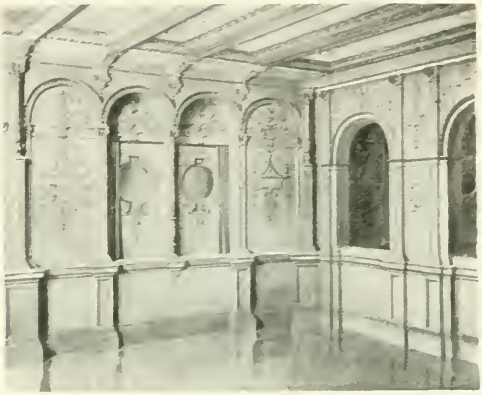


Fig 3.
Corner in Dining Saloon

elevator grille, and it can be said without contradiction that no ship before these two has ever had a stairway of such a size, resembling that of a hotel or mansion. There are two electric elevators in the well, which serve five decks, *viz*: the main, upper, shelter, promenade and boat decks.

The staircase and entrances are in the sixteenth century Italian style, the woodwork being of beautifully figured French walnut. The grille of the lift is of aluminium, and is exceedingly tasteful in design, as well as being light, the advantage in weight of aluminium over iron or bronze being at least 20 tons.

Fig. 2 is a view of the upper first-class dining saloon, the upper and lower saloons being situated on the upper and shelter decks respectively. Between the two saloons is a large open space terminating in a groined dome designed to carry out one complete scheme, producing a very airy effect. The rooms are executed in oak in the François Premier style which prevailed in the years 1540-1550. A feature of the panel decoration is that no piece of carving is an exact reproduction of its neighbour. All the carving is cut back from the solid wood. Fig. 3, which represents a corner in the dining saloon, gives a good illustration of the carving.

Fig. 4 is a view of the library and writing-room, and is panelled in sycamore. The book-case forms the panelling of one side of the central portion of the room. On the opposite side of the room is an open fireplace with carved chimney-piece of white statuary marble, surmounted by a mirror.

The first-class smoking-room is situated on the boat deck, and can be reached by a lobby entering from the open-air promenade or through the lounge. The style of decoration is the same as the grand entrance, but is much richer in the carvings, and is relieved from all the panels with an inlaid border of sycamore. An interesting feature is a jube extending the length of the room, divided into recesses, with divans and card tables: this is illustrated in Fig. 5. The windows in the recesses are of unusual size and of unique

Fig 4
A View of the Writing-Room

Fig. 5.

Alcove in First-Class Smoke-Room.

design for ship-work. They have semi-circular arches, and have the appearance of the windows of an old-fashioned private house. In the centre, at the forward end of the room, is perhaps what may be considered the main feature of the scheme—an open fireplace with a massive chimney-piece surmounted with a carved wood hood. This is well illustrated in Fig. 6.

Fig. 6

Fireplace in First-Class Smoke-Room

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

IT has now been officially intimated that the name *St. Vincent* is to be given to our new battleship. It was expected that a beginning would have been made with the vessel early in December, but it will be about the end of the month before a start is made. A good deal of preliminary work has, of course, been going on for some weeks. Glad as we shall be to see the new ship started, we are by no means short of work, for there is still a good deal of repairing and refitting to be done. A hundred additional hands have been taken on during the last few weeks, and it is quite likely that more will be required during the winter. In this connection some figures given in a speech by Mr. T. A. Bramsdon, M.P., are interesting. He stated that whereas in June, 1906, there were 8640 men employed in the yard, there were at present 9248, an increase of 608. At Devonport the increase was 586 and at Chatham 564. It is stated that contracts for the construction of the new lock will be invited early in the New Year, and that work will commence in the spring. The battleship *King Edward VII.*, flagship of Admiral Lord Charles Beresford, commanding the Channel Fleet, arrived on December 12th for a refit. While she is in hand arrangements for the cooling of her magazines are to be undertaken and her wireless telegraphy rigging brought up to date. The battleship *Renown* having finished her Royal duties, is to revert to warship duties. Her 6-inch guns are at last to be replaced and she is to join the Home Fleet as a special service vessel. The *Renown* has been used for purposes other than as a warship for the past five years. She conveyed the Prince and Princess of Wales to India in 1905, the Duke of Connaught went on a tour of inspection in her to the Mediterranean, while her last service was to convey the King and Queen of Spain to Brest on the conclusion of their visit. His Majesty's yacht the *Victoria and Albert* is undergoing a refit and she is also being redecorated. Orders have been given that she is to be ready for the King's use by February 1st. The battleship *Dreadnought* is said to be giving excellent results with the new propeller blades. Her new steering gear is also reported on favourably. In connection with the building of the *Dreadnought* the Admiralty have awarded gratuities ranging from £10 to £25 to fifteen foremen and inspectors. This is a new departure, for hitherto the custom has been only to make a grant of about £50 or so to a constructor. The examination and refitting of the destroyers of the Reserve Flotilla is being carried out, and all the available docks are occupied by these craft. The *Quail*, which was cut in half during the manœuvres in August, has had her repairs completed and has been taken out of the dry dock and placed in one of the basins. She will shortly be ready to proceed to Sheerness to rejoin the flotilla there. The battleship *Prince George*, flagship of Rear-Admiral Farquhar, commanding the local Division of the Home Fleet, broke from her moorings on the night of December 5th, and was carried on to the stem of the new armoured cruiser *Shannon*, which had arrived from Devonport for her gun trials. The cruiser was only slightly damaged, but when the *Prince George* was docked it was found that some of the plates amidships on the starboard side were badly indented below the waterline. Part of the bilge keel was torn away and other damage done. Several accidents of the kind have happened during the last few years, the large amount of dredging that has been done in the harbour being considered by many to be the cause of the mischief. Whether that is so or not, more dredging is to be done. In consequence of the large number of ships anchored in the harbour the moorings are to be rearranged early in the New Year. The upper reaches of the harbour are also to be dredged so as to enable more vessels to be moored. Battleships and cruisers now swing with the tide, but in future they are to be moored head and stern, so as to give more room. A smart performance has been accomplished by the cruiser *Berwick*. While the repair ship *Cyclops* was towing the destroyer *Fawn* round from Invergordon the tow rope broke off the Royal Sovereign lightship, and the destroyer nearly collided with the *Cyclops*. The vessels being on a lee shore the coastguard wired here for assistance. The *Berwick* was ordered to complete her crew and proceed to the scene, but when she got there her services were not required, the *Cyclops* having been able to take the destroyer again in tow and bring her here. The Lords of the Admiralty have expressed their appreciation of the rapid manner in which the *Berwick*, though only having a nucleus crew, was completed for sea on a signal being so unexpectedly made. It certainly shows the value of the ships of the Home Fleet, if they do only have three-fifths crews, when a vessel can embark the other two-fifths at such short notice and proceed to sea almost immediately. The *Cyclops* left for Chatham on December 11th. The *Fawn* remains here to be put right, having only been temporarily repaired at Invergordon. Trials with an invention for improving fire control are shortly to take place here under the direction of the Admiral of the Fleet, Sir Arthur Wilson. The battleship *Vengeance*, the cruiser *Ariadne*, and the destroyers *Kale*, *Derwent*, *Doon* and *Ribble* will take part in the trials. The old battleship *Hero*, which for so many years was a tender to the gunnery establishment, retained her connection with gunnery to the last. She was towed round to the Kentish Knock, where the ships of the Channel Fleet battered her out of recognition. It is understood that some valuable information has been gained as the result of the firing experiments, but of course everything is confidential.

Chatham Dockyard.

Speaking at the Mayor's banquet at Gillingham, Alderman J. H. Jenkins, M.P., said that Chatham had a practicable river and one that was navigable, and if there was any defect in the river the Admiralty should see to it by all means, and see that it was sufficiently deep and wide to bring up the biggest battleship that ever had been in the yard. When the Estimates were being discussed he moved an amendment, he said, because he considered that every naval base should have a dry dock sufficiently large to take a *Dreadnought*. That ought to commend itself to the Admiralty. If it was the intention in the future to build huge battleships of the type Mr. Jenkins mentioned, facilities should be provided whereby they could dry dock and repair the ship immediately. It was little thought at the time that there would so soon be a reply to this. Whether the Admiralty have taken the Alderman's advice or not I cannot say. At any rate it was announced at a meeting of the Chatham Town Council on December 11th that the Admiralty were going to spend £100,000 in dredging the Medway between Chatham and Sheerness. Four dredgers will, it is stated, be at work within a month, so presumably operations will commence with the New Year. It is intended to make a sufficient depth of water to enable the largest ship to pass up the Medway to Chatham. It would almost appear as if the Alderman had received the official intimation privately beforehand. It is encouraging to note that there are 500 men more at work here now than there were six months ago, the engineering department only being 200 below the strength it was at the time of the late war. Many of the men are, however, only temporarily employed. The trials of our new armoured cruiser *Shannon* having proved satisfactory, she returned on December 14th, and is now being prepared for her maiden commission which will be in the Home Fleet. The battleship *Africa*, having completed her refit, proceeded on December 7th to Sheerness and coaled, leaving there a few days later to rejoin the Channel Fleet at Portland. The battleship *Victorious* has also completed her refit and returned to Sheerness to rejoin the Home Fleet, and the *London* has come in. Her refit is to be commenced on January 6th and completed by March 20th. The cruiser *Topaze*, of the Channel Fleet, has also come in for her annual refit. The scouts *Attentive* and *Adventure* and the destroyers *Dee*, *Cherwell*, *Exe*, *Lively*, *Thrasher* and *Sprightly*, of the Permanent Flotilla, arrived on December 6th, on completing their exercises in the North Sea. They remain to give Christmas leave to their crews, but most of the vessels will require overhauling before going on another cruise. In connection with destroyers it is interesting to note that the Admiralty have allotted an additional £8000 to the yard for wages in connection with the proposed overhauling of these

craft. The repair ship *Cyclops* has arrived from Portsmouth; she will, I understand, join the Home Fleet Destroyer Flotilla. The torpedo gunboat *Leda* (whose name was inadvertently given last month as *Jeda*) is in hand undergoing her annual refit.

Sheerness Dockyard.

Sheerness has been honoured of late, both the German Emperor and Empress having selected Port Victoria as their port of embarkation for the Continent. Before the Empress left she gave a luncheon party on board the Imperial yacht *Hohenzollern*, both Admiral Sir Gerard Noel and Vice-Admiral Sir Francis Bridgeman being invited. The latter officer entertained Rear-Admiral Imgenohl and the principal German officers the previous evening at Admiralty House. When the Emperor left on December 12th no ceremony was observed by his Majesty's special request. On both voyages the yacht was escorted by the cruiser *Konigsberg* and the despatch vessel *Sleipner*. On December 7th we had a visit from Mr. J. B. Marshall, C.B., the Director of Dockyards, who had a conference with the Captain-Superintendent (who has now happily recovered from his recent accident) and the heads of the various departments. Business in general is fairly brisk. The *Vestal*, which has been converted from a seagoing sloop into a tender for service with the Portsmouth Gunnery Establishment, was taken out of the steam basin on December 6th, and will shortly proceed to Portsmouth to commence her new duties. The sloop *Rinaldo*, which has been similarly converted, is to be commissioned here on January 7th as a tender to the Devonport Gunnery School, in place of the old gunboats *Snap* and *Badger*. Three of the destroyers we have had in hand have gone. The *Vulture's* refit was completed on December 2nd, and she has now rejoined the Nore Active Service Flotilla. The *Violet*, which was almost cut in two in collision at night exercises in the North Sea in July, has been completed, and on December 7th left for Devonport to rejoin the Home Fleet Flotilla at that port. Her machinery was thoroughly overhauled and repaired, in addition to the damage she sustained being put right. The *Success*, of the same flotilla, which has had her boilers retubed, has also gone back to the western port. Several destroyers have come in for refits. The *Nith* and *Ure*, of the Permanent Flotilla, were placed in dry dock on December 6th, and the following day the *Swale*, *Locust*, *Wear* and *Ettrick*, also of that flotilla, were taken into the steam basin. We had a visit from the First Cruiser Squadron, commanded by Rear-Admiral Sir Percy Scott on December 13th. The vessels had been firing at the Longsands Range in the North Sea, and came into harbour to coal before returning to Portland to rejoin the Channel Fleet and give Christmas leave. The old battleship *Hero* came in here preparatory to going out to the Kentish Knock to die, as it were. It is a coincidence that it should have been from the Medway that she made her first trip to sea for her trials about twenty years ago. The experiments aroused keen interest and a large number of officers, including the Commander-in-Chief at the Nore, went round in the special service vessel *Undine* to witness the firing. The poor old *Hero* is never likely to be seen afloat again, and she now rests on the Kentish Knock sands. It would cost far more money to salve her than she would be worth. Several from this yard belong to the recently formed association of constructive, engineering and electrical draughtsmen employed at the Admiralty and Royal Dockyards. The association was formed to facilitate the interchange of views of the members of the various departments and to promote generally the interests of the technical branch of the Civil Service. The first annual meeting was held on November 30th at the Holborn Restaurant, London, there being present a number of Admiralty draughtsmen and representatives from Portsmouth, Devonport and Chatham, as well as from this yard. The proceedings were, of course, private. A distressing accident occurred during the severe gale on December 14th, a steam cutter belonging to the torpedo gunboat *Speedwell* having capsized within a yard or two of Sheerness Pier with fourteen men on board, only six of them being saved.

Devonport Dockyard.

The latest official announcement concerning our new vessel, the *Collingwood*, is that she is to be laid down on January 4th, which will be a week after her sister vessel, the *St. Vincent*, is laid down at Portsmouth. But it is quite likely that there will be a still further postponement, although there is a large amount of material ready. The progress of the *Téméraire* is very satisfactory, practically the whole of the side and barbette armour being in position. With the hoisting on board of the tripod mast—which weighs 45 tons and is 82 feet long—almost all the heavy weights are in position. The vessel is ready for docking, and then the work of boring out the four stern glands will be proceeded with. This will take about six weeks to do, and meanwhile the under-water fittings will be completed. During the vessel's stay in dock the engine-rooms will be got ready for the turbines, which are expected early in January. The cruiser *Minotaur*, having had her port propeller altered in pitch and the crosshead bearings of both engines adjusted, left the Prince of Wales Basin on November 28th to resume her trials and returned on December 3rd. Good progress is being made with the work of equipping her 9·2-inch barbettes. The *Minotaur's* sister cruiser the *Shannon* underwent her steam trials simultaneously with the *Minotaur*, this being the first time, I believe, that two vessels of the same class have carried out their trials together at this port. The refit of the cruiser *Gibraltar* has been completed and she has carried out her after-repair trials. She is to be commissioned on January 4th as a special service vessel in the Home Fleet. It is not, however, known what service she will be selected for ultimately; at any rate, she is now thoroughly up to date and fit for any service required of a vessel of her class. The *Gibraltar* is not at all a modern vessel, having been laid down eighteen years ago, and has since her launch been almost constantly employed. The cruiser *Andromeda* was paid off from the Home Fleet on December 18th and taken in hand for a refit. Orders have been received to forward estimates for preparing the double bottoms of the old battleship *Howe* as oil fuel tanks. The *Howe* is one of the *Admiral* class, of which two other vessels are in the reserve at this port—the *Anson* and *Benbow*. They were expected to have been sold long since, having been stripped of all fittings and equipment except the main armament. The battleship *Mars* has just had three of her 12-inch guns replaced. They had been in use since 1896 and are necessarily in need of overhaul, for which purpose they are to be sent to Woolwich and tested and brought up to date. These big guns are not so expensive after all as some writers would have us believe. Rear-Admiral S. M. Eardley-Wilmot, the Superintendent of Ordnance Stores, has been here for his annual inspection. He brought his visit to a close by an inspection of the new building which is being erected at the Keyham Extension Works for the storing of eight hundred Whitehead torpedos. Throughout the service the deepest sympathy will, I am sure, be extended to the Commander-in-Chief of this port, Admiral Sir Lewis Beaumont, whose wife has just died. Lady Beaumont, who was an American, was married to her husband when he was a captain on the North American station. Since then she has resided at Victoria, British Columbia, when Sir Lewis was Commander-in-Chief of the Pacific Squadron, and at Sydney, when he commanded the Australian station, and is, therefore well known to a large number of service men. During nearly three years' residence at Devonport Lady Beaumont took great interest in all deserving causes and helped to the utmost of her ability. Admiral Beaumont will shortly be leaving us, probably before March 20th, when his three years expire. His successor will be Vice-Admiral Sir Wilmot Fawkes, who leaves the Australian Squadron in January. The announcement came as a surprise to everybody, as it was confidently expected that one of the unemployed admirals would have been selected for the post. Indeed, the name of almost every available admiral has been mentioned in this connection. I understand it was offered to several, but they declined it. An interesting paper was read the other day before the Dockyard Boilermaker Apprentices' Association by Engineer-Lieutenant P. C. W. Howe the assistant to the engineer manager, on "Water Tube Boilers of the Small Type." Lieutenant Howe explained the reasons which led up to the introduction of the small tube boiler about seventeen years ago. It was altogether a most instructive paper.

Pembroke Dockyard.

The *Boadicea* is making headway rapidly. The cast-steel

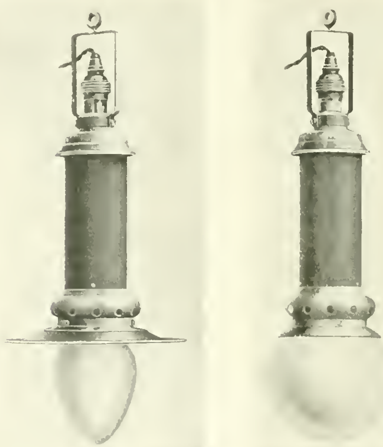
sternpost has been delivered, machined and placed in position, and the erection of the frame-work of the stern is now being proceeded with. It was expected that boring operations on the four propeller shafts would have been commenced in January, but that is now regarded as impossible. Arrangements, however, have been made to accommodate the staff of Messrs. John Brown & Company, the engineer contractors, with a workshop during the second week in January, when they are expected here. It is quite likely that it may be found necessary to postpone the launch for a month or two. With regard to our other vessel, the *Defence*, the shafting of the propeller engines has been completed, and the work of finally coupling the parts is being proceeded with. The twenty-four Yarrow water-tube boilers are all completed, and the main steam pipes connecting up the engines are in place. The official water tests of the boilers have also been carried out. The work of planing the roller paths of the barbettes has been completed, and all the gun-carriages, mountings and gun-houses can now be put in position. The twin-mounting for the two 9·2 inch guns in the after barbette, together, with the gun-house, and the mountings and gun-houses for two of the ten 7·5 inch guns are on board. The twin mounting and gun-house for the fore barbette has been delivered and will shortly be shipped. The other mountings and gun-houses have not yet been delivered. I said last month that a damaged destroyer might put in here, and on December 7th one did arrive, the *Express*, of the Channel Fleet Flotilla, accompanied by the *Foyle*, putting in in a damaged condition. The repair ship *Aquarius* had collided with the *Express* at Lamlash, damaging her stern plating and breaking her port propeller. The artificer ratings of the *Aquarius* temporarily repaired the *Express* to enable her to proceed here, where she has been docked. To permit of the repairs being expeditiously carried out a number of electric arc lamps have been temporarily fitted round the dock. An order for building fourteen fenders or "camels" for use at Dover has been received. They are for use in connection with the moorings of large war vessels, the idea of building them being suggested it is said, by a portion of the harbour works, alongside which it was proposed to berth ships, being carried away during bad weather. The fenders will be 40 feet long, 30 feet wide, and 7 feet deep; they will be built solid of fir logs and sheathed with elm. Mr. Owen Philipps, M.P., has at length had a letter from Mr. Edmund Robertson with reference to the dockyard petitions. The Parliamentary Secretary to the Admiralty says that "it is impossible at present to state definitely when the Board's decision on the dockyard petitions will be announced. It appears unlikely, however, that the replies can be sent out until early next year, as when the Admiralty replies are formulated it will still be necessary to consult the Treasury should any increase be decided upon, but the matter is being expedited as much as possible."

Messrs. Matthew, Keenan & Co., Ltd., of Bow, London, E. and Glasgow, have recently carried out the whole of the non-conducting covering for two ships for the Royal Egyptian Mail Co.; for six P. and O. steamers; and for five steamers for Fratelli Consulich, Trieste.

Sea Rings.—It must be a matter of satisfaction to the Quaker City Rubber Co. that their patent Sea Rings Packing has made such rapid strides for a prominent place in the packing market. The claim originally made that it was an automatic self-adjusting packing appears to be justified, judging from the results that have been obtained; for example, packing put into feed-pumps in December, 1906, doing heavy duty night and day have not been touched since they were put in and there is no evidence of any necessity for renewal. We understand that superintendent engineers have had rings running eight and a half months without being touched. A special feature of the packing is the infinitely small risk of jamming the rod, as the gland pressure is taken on the heat of the packing while the tongue or lip is free to allow of any lateral movement of the rod and at the same time is kept up against the surface by the fluid pressure at the back. Messrs. Ronald Frist & Co., of Coronation House, Lloyds' Avenue, London, are the managers in this country for the Quaker City Rubber Co., and we understand that recently they have booked a large foreign order for sea rings entirely owing to their advertisement in this paper.

VICTOR ARC LAMPS.

THE arc lamps illustrated in the adjoining diagrams are of the miniature arc lamp type manufactured by the Electric and Ordnance Accessories Company, Limited, of the Ste'lite Works, Aston, Birmingham. The special features of the design may be summarised as follows: there is no clock-work or mechanism of any kind to be affected by gases or deposits, and there are no shunt-coils or dash-pots. There is only one moving part, which is contained within a sealed tube; another important part is the clutch, which is constructed on an extremely simple principle. The body of the device consists of a solid brass casting having a cylindrical hole bored through it to take the positive carbon. At the top is arranged a soft iron core overlapping



the casting half-way round. At the bottom end there is a slot, in which is pivoted a soft-iron armature, to the end of which is fixed a moulded steatite gripper.

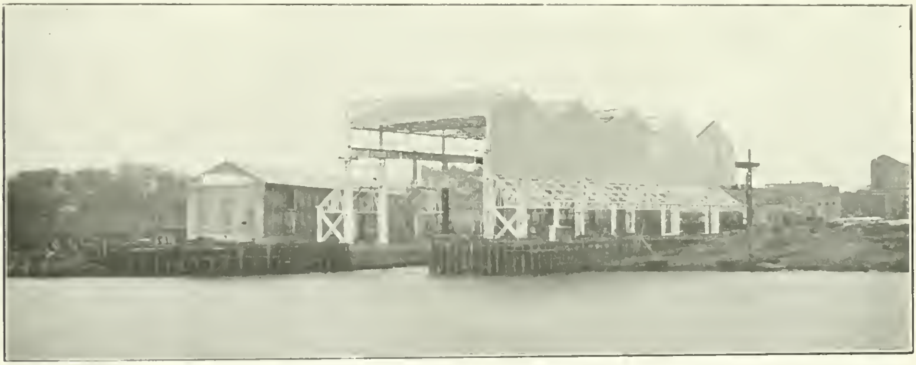
The method of operation is as follows: on the current being switched on the armature is drawn outwards, and holds the carbon by means of the gripper; the whole clutch is at the same time drawn up, and tends to take a balancing position in the air gap formed by the iron core of the lamp mechanism. The whole of the details of construction have been standardized, and consequently no difficulty need be experienced as to renewal and repair of parts.

These lamps are manufactured under almost perfect conditions in order to ensure absolute interchangeability, and also mechanical and electrical efficiency.

YARROW & COMPANY'S NEW WORKS ON THE CLYDE.

THE fact of the removal of Messrs. Yarrow & Co., Ltd., from Poplar, on the Thames, to entirely new works at Scotstoun, on the banks of the Clyde, and the good and sufficient reasons which that renowned firm have had in seeking a new *venue* for their operations, have been sufficiently proclaimed and commented on by all interested in industrial and rating questions on the Thames, as well as the Clyde and other districts. It is needless, therefore, at this late stage to say anything of these matters, especially in view of the fact that the fine new works at Scotstoun are now practically complete, and as regards the shipbuilding section in good-going order, although as regards equipment of the engineering and boiler-making sections nothing like a full transference or installation of machinery and appliances has been effected. Throughout the new establishment, however, the work of organization and the laying out of fitting-out purposes, which is a novel feature in the Clyde, if not in all other shipbuilding districts of the United Kingdom. Ground was first broken in March, 1906, and the erection of the new premises was begun in May, and though, as has been indicated, it will be some time before the whole establishment is fully equipped and in working order, the various shops and offices are completely erected and the laying out of the establishment generally a thing accomplished.

When fully set agoing the works will give employment to between 1000 and 1200 workmen. The shipbuilding section, as has been said, is already fully in operation, between 250 and 300 workmen being engaged, the work on hand consisting of four torpedo destroyers for the Brazilian Government. These vessels, which are 1260 to 1264 in the numbering of Messrs. Yarrow's productions, are part of a fleet of ten vessels which the firm have the contract for, and which they will lay down and complete, in couples gradually, until the contract is exhausted. One of our general views (page 214) shows several of the building berths occupied by these vessels, and our illustration on page 216 shows



Yarrow & Co.'s Works.—View from River Clyde, showing covered-in Basin

working systems and general methods are matters practically complete. The railway and transport facilities, the installation of electricity for lighting and power purposes, the laying down of pipe and other transmission features for hydraulic and pneumatic power purposes—all these already give evidence of the care, skill, and far-sightedness with which the new establishment has been conceived and brought into being.

The new works—two general views of which we give as seen from the Clyde—are situated in close proximity to Scotstoun West Station, on the Lanarkshire and Dumbartonshire Railway, and a stone's-throw from Dumbarton Road, the main tram thoroughfare between Glasgow and Clydebank. Occupying an area of about twelve acres, square in shape, having on the south a river frontage of about 784 ft., and extending backwards from the river about 680 ft., the new works embrace engineering shops, boiler shops, general administrative offices, iron shipbuilders' machine sheds, blacksmith's shop, carpenters' and joiners' shops, open shipbuilding berths (eight in number), and, lastly, a covered-in tidal basin for one of the vessel's decks being laid down and prepared on a template arrangement before being structurally worked into the ship on the stocks. This work of templating the decks, bulkheads, etc., is presently being done on the floor of the fine boiler shops, seeing that these are not yet, or only partially, equipped for the carrying on of the ordinary boiler work. It is the firm's intention, however, to make an earlier start with operations in this highly important department than in their engineering department. One of various reasons for this consists in the fact that the boilers for the ten Brazilian torpedo destroyers, four of which are already well advanced in the shipyard, have parts about 18 ft. long, and are in consequence somewhat unwieldy for transport from the works at Poplar, where, as will be understood, Messrs. Yarrow are still busily carrying out contracts. These parts will be assembled, and the finished boiler readily put on board ship at Scotstoun.

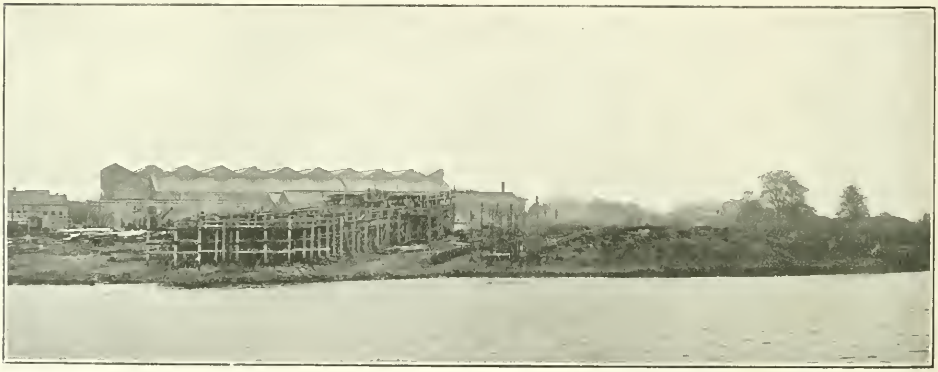
The construction of the Yarrow boiler, which, it may be stated, since the Boiler Committee's report has become more and more popular, will evidently form a very large part of the work carried on at Scotstoun.

The firm intend in their new establishment to strictly adhere to special classes of construction with respect to ships as well as boilers, namely, vessels of exceptionally high speed and of exceptionally shallow draught, many of which will be built and dismantled and shipped in pieces for re-erection at their destination abroad. It is well known that, by adhering to certain specialities, not only can the cost of construction be minimised, but the maximum of efficiency secured, and for this reason the firm have no intention whatever of embarking in the construction of, or in any way competing for, the larger class of vessels, such as have long been built so successfully on the Clyde.

The Clyde, abreast of the building berths, is about 500 ft. in width at high-water level, and as the berths are disposed at an angle of 50 deg. relatively to the course of the river, the length of launching run will be thoroughly ample for the very largest vessel the firm contemplate constructing. The berths have a length, above the line of high-water, of from 210 ft. to 220 ft., and they occupy about 300 ft. of the river frontage. The depth of water opposite the berths is already 20 ft. to 24 ft. at low tide, which, in itself, affords ample depth for safely floating vessels of such comparatively small displacement as are to be built, but by increased depth, through further dredging by the Clyde Trustees, the firm will be able safely to launch their largest vessels with the minimum of checking arrangements.

To the west of the building berths, and like them set at an angle of 50 deg. relatively to the course of the river, is the covered-in fitting-out basin, the construction and appearance of which will be gathered from one of the views we give of the river front. The dock is about 320 ft. in length, by 86 ft. clear width at the cope, and has a central depth at low tide of 19 ft. at the river end and of 16 ft. at the head. The covering in structure, which is entirely roofed with glass, is about $61\frac{1}{2}$ ft. clear height above cope level. At a height of 50 ft. 9 ins. is the rail level on which is carried a 50-ton overhead travelling crane, having an auxiliary hook of 10-ton lift. This crane has a span of 93 ft., being amongst the largest for cranes of this power in the kingdom. This notable appliance is by Messrs. Applebys, Ltd., of Glasgow, Leicester and London, and in design is similar to other two 50-ton cranes installed in the machine and boiler shops. The dock is flanked on each side with lean-to working sheds, well equipped with the lighter tools always required in finally adjusting and fitting machinery on board ship. The girders carrying the 50-ton crane project at the inner end of the dock for about 50 ft. beyond the roofing, and 20 ft. beyond the last of the line of supporting columns. This enables the overhead traveller to lift materials, and items of ship's machinery, from the trucks on a circular line of ground railway of the usual standard gauge, which is in touch with the engineering and boiler shops, and, of course, with outside systems of railway.

The general offices, with, on each side, the two main blocks of buildings—boiler shops on the east and engineering shops on the west—together form almost the entire northern boundary of the works, which is parallel to South Street and to the Lanarkshire and Dumbartonshire Railway, access from which is, therefore, highly convenient. The whole of the structural work of the new establishment was contracted for by Sir Wm. Arrol & Co., Glasgow, that firm preparing and erecting all the constructural steel work, which amounted altogether to some 2650 tons. The brick and masonry work generally and the excavating of the wet basin and building berths was undertaken by Messrs. Morrison & Mason, Glasgow, with whom, as with the chief contractors themselves, the Yarrow firm dealt direct. The whole undertaking, from the first, has been under the able supervision of a member of Messrs. Yarrow & Co.'s staff, Mr. R. D. Keay, who has also the credit of superintending the work of expanding the Poplar establishment.



Yarrow & Co.'s Works —View from River Clyde showing Building Berths and Boiler Shops

The general offices are of substantial masonry and of handsome design, and internally are being equipped with every regard to rapid and accurate despatch of affairs. The engineering and boiler shops are constructed of steel, the boundary walls being of brickwork 9 ins. thick, built in panels between steel vertical standards and horizontal runners of H section. Up to a height of 15 ft. they are still of brick, but of the

more substantial thickness of 14 ins. Generally speaking, this panel style of shop construction is somewhat of a novelty in the West of Scotland, it being common to employ corrugated galvanised iron sheeting above the height of the more substantial walls. Compared with the works having walls of corrugated galvanized iron, the brick "panel" system affords more warmth to the workers in winter, and is cooler in summer than the corrugated sheeting: while, as is well known, reverberation from the latter system of walls, with noisy work going on, is a source of confusion and much discomfort.

The engineering shops to the west are 219 ft. long by 152 ft. wide, arranged in three bays, one of which machine shops, one 27 feet wide between columns, the other 33 ft. wide. In the larger of these two side bays, there are one 20-ton traveller, and one 5-ton Adamson traveller carried on girders 30 ft. 6 in. above floor, and in the other and smaller bay there is one 5-ton traveller carried on girders at 20 ft. 6 ins. from floor to rail level.

The boiler shop block is 300 ft. long by 152 ft. in width, and the height from floor to under side of roof wind-bracing is 49 ft. Besides a lean-to portion along the south side, there are two bays, each of the height stated, one of them being 60 ft. 9 ins. wide, and the other 47 ft. The central and wider bay is for assembling and erection purposes, being served by the

Yarrow & Co.'s Works.—Interior of Engineering Shops

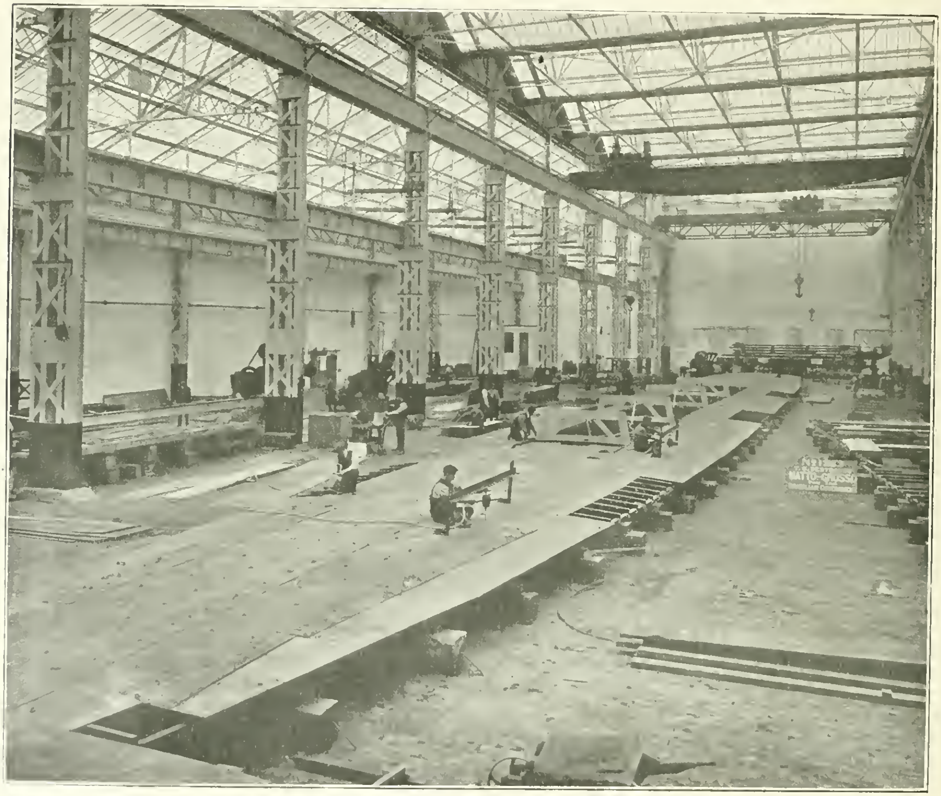
is less in height than the other two. The columns marking the bays, as may be gathered from our illustration of the boiler shops on page 216 (the two departments being structurally alike) are an assemblage of H-bars tied with lattice work, and spaced at 30 ft. centres along the length of the shops. The central bay, forming the heavy machine and erecting shop, has a clear width between standards of 60 ft. 9 in., and a total height from floor to under side of roof wind-bracing of 50 ft. This bay is served by a 50-ton traveller of Applebys' make, at a height of 41 ft. 8 ins., from the floor to crane rail level. At a height above floor of 30 ft., girders carry a lower crane of 5-ton capacity by Broadbent. The two side bays are light 50-ton overhead Appleby traveller, similar to the one in the engine shops, and of which, when subjected to a test load of 75 tons, a view is given above. In this bay there is also a 10-ton overhead Broadbent crane.

Throughout the works the power employed is electric, save in the case of the power hammers in the smithy, which will be worked by steam, and in the boiler shops where a stationary hydraulic 13-ft. gap riveter of 60 tons capacity and a 300-ton press and a few other tools will be installed. In the shops, and outside at the building berths and fitting-out basin, pneumatic portable tools are already largely in evidence. The artificial lighting of the various sections is also by

electricity, but provision is made for gas jets in odd places and notably at each machine tool in the engine and boiler shops. The works are supplied with the current from the generating station of the Clyde Valley Electric Supply Co., at Yoker, about a mile further down the Clyde. The current is three-phase, alternating, 11,000 volts, delivered at a substation near the engineering shop, where it is transformed to alternating current at 400 to 440 volts.

Parallel to the boiler-shop building, and about a 100 feet nearer the river, is the steel-workers' shed, with sides which for most part can be left open or closed according to weather conditions, and entirely roofed with glass. This contains, besides the necessary variety of shearing, punching, flattening and straightening machine tools, the heating furnaces and bending slabs (with attendant screw boards) requisite for the work of giving proper curvature to plates and bars. Most of the machines here are driven from line shafting, and the shed is well appointed as regards the hoisting and holding up of the material to the various machines. Overhead runnings are adopted, and every allowance is made in the roof arrangements for the extension of this system.

In the open yard space between the front of the steel-workers' shed and the heads of the building berths are a number of motor-driven tools, including punching and shearing machines, plate-bending rolls, joggling rolls, etc., the current to which is carried by cables on light steel masts, so placed that the machines may be shifted wherever most convenient for the work in hand. Radiating from the steel-workers' shed and traversing the full length of the berths is a system of 24-in. gauge light railway which greatly facilitates transport of material.



Yarrow & Co.'s Works—Interior of Boiler Shops—Preparing Deck Plating

To the west of the tidal basin and parallel to it is a range of two-storey brick buildings, which are devoted to the pattern-making, joinery and polishing shops. In the upper floor is the moulding loft where the vessels are laid off full size. The length of building is 273 ft. 6 in., and 44 ft. in width, and both storeys are copiously lighted from side windows. The machinery, with which the ground-floor, containing joinery and pattern-making shops, will be

plentifully equipped, will all be motor-driven; the motor, which will drive machines in series from line shafting, will be located in a well-constructed chamber underneath floor level. Belts will connect with machines through holes in the floor, thus keeping all belts well clear of the workmen, and in no way interfering with the handling of material.

At right angles to this range of shops, and at its northern end, parallel to the boiler shop, is a substantial building containing the smiths' shops. Provision is made here for 14 smiths' hearths, the blast for which will be supplied by a fan of Sturtevant make, driven by an electric motor, which will also drive shearing press, emery grinder and grindstone. There will be four steam hammers of varying capacity, the largest being of 40-cwt. power, and a number of "Oliver" hammers. The steam for actuating these hammers, which are the only steam-actuated appliances in the works, is supplied from a cylindrical return tubular boiler, situated between the shops and the engineering section.

In the splendid new works, so inadequately described in the foregoing, and under the altered and improved conditions as to lower rates, lower cost of material and of labour, and enhanced means of transport, etc., it may confidently enough be anticipated that Messrs. Yarrow & Co. will gain the just reward of their enterprise. The firm believe that had they remained in the South, it would have been impossible to continue—not to say develop—their business in face of the competition with firms favourably placed as regards the above factors. They estimate that in their new *habitat* the cost of production of the special class of vessels they build—vessels of high speed and of abnormally light draught—will be reduced fully 10 per cent. as compared with Poplar.

ELECTRIC PUNKAH.

A NEW and ingenious device which will be of interest to all, and particularly to those connected with marine engineering, has just been placed upon the market by Messrs. Bergtheil & Young, Ltd. of 12 Camomile Street, London, E.C. The invention we refer to takes the form of an Electric Punkah designed to take the place of the hand-pulled machine familiar to most travellers in the East and others who are accustomed to the old-fashioned Punkah introduced some years ago into our large liners.

We have had an opportunity of seeing the new patent Electric Punkah working at Messrs. Bergtheil & Young, Limited's, show-room in the City, and it certainly marks a new era in methods of ventilation. It achieves all that is accomplished by the hand-pulled machine, reproducing with absolute faithfulness the "flick" peculiar to same, and which indeed is the *most* necessary characteristic of all punkahs. Another feature which will commend itself is the simplicity of the device. There are no intricate parts to get out of order and the method by which the drive is obtained is as follows:—

The arrangement consists of a rigidly suspended motor with conical pulley on the under side, and a swinging frame to which a short curtain is loosely hung. Attached to the upper side of the frame is a quadrant, pivoted on a bearing pin and controlled by springs. This quadrant is pressed to one side or the other of the coned pulley of the motor with which it engages. When the motor is started, the pulley rolls against the quadrant which carries it away from the vertical position. In fact, there is a sufficiently strong pull given to the quadrant to take it and the punkah clear of the pulley to a point from which it tends to swing back again by gravity. On the return stroke, therefore, the motor is still running, and as the quadrant now strikes the opposite side of the pulley the punkah is swung in the opposite direction with a "flick." This cycle of operations is repeated while the motor continues to run.

Messrs. Bergtheil & Young inform us that they have adapted their new patent Electric Punkah both for ship and shore use. The description above refers to the latter type which we have had the opportunity of seeing in actual operation. In the ship's type of punkah, the drive is obtained in precisely the same way, with the exception that in order to economise room, the motor is fixed with the spindle in a horizontal position and the drive is obtained by the quadrant passing under and over the pinion instead of on either side.

The illustration on page xxiii shows the punkah installed on board the Orient Steam Navigation Company's S.S. Omrah, as adapted for use in ships' saloons, railway carriages or indeed any position where economy of space is necessary.

The advantages of the new patent Electric Punkah are obvious: the electric power needed is comparatively small, as part of the work is done by the impetus given by the fall of the punkah as it returns to engage with the pinion on either side, and, of course, where this device is made use of hand labour is entirely done away with. It has taken some years to perfect the invention, as difficulties which have surrounded the problem of a successful mechanical punkah had to be overcome. These difficulties consisted chiefly of the reproduction of the "flick" which has hitherto evaded would-be inventors, and another great point was to render the apparatus quite noiseless.

The new patent Electric Punkah has overcome all these difficulties.

Motor-Launch "William Lowrie"

Built for the Newcastle-on-Tyne Sailors Society. The launch is 30 ft long, by 7 ft beam, fitted with a four cylinder 20 H P "Wear" Motor. The launch has been presented by Miss Lowrie in memory of her brother, the late Captain William Lowrie. The Launch has a speed of ten miles per hour.

OBITUARY.

Edwin Griffith.—By the death of Mr. Edwin Griffith, M.I.C.E., a partner in the firm of Messrs. Denny & Co. engineers, Dumbarton, which took place on the 7th of December, at his residence Bellfield Dumbarton, the younger race of marine engineers have lost another member of outstanding promise. Deceased was only in his fortieth year, and his death was most unexpected. Having become seriously unwell on December 1st, he was operated upon for appendicitis on the day previous to his death, and it was shock supervening on the operation which caused the fatal event. Mr. Griffith was a native of Holyhead, and having acquired a sound scientific education and earning a Whitworth scholarship, he commenced his professional career as an engineer in the Fairfield Shipbuilding and Engineering Works Govan. Subsequently he became head draughtsman with the Wallsend Slipway Company, Newcastle. About three and a half years ago he returned to the Clyde as manager to Messrs. Barclay, Curle & Co., at Whiteinch, and about two years ago he went to Dumbarton to act in a similar capacity for Messrs. Denny & Co., of which well-known firm he was assumed a partner only about a year ago.

A TUBELESS SEMI-FLASH BOILER.

IT is somewhat refreshing to come across any device which departs in construction from the recognised methods, and at the same time gives an excellent result. It was our good fortune, a few days ago, to have the opportunity of inspecting a new tubeless semi-flash boiler, which has been designed by Mr. G. R. Steward, M.I.Mech.E., of 28, Victoria Street, Westminster, and by reference to the two adjoining illustrations, it will be recognised that the design has distinct elements of novelty in it. Fig. 1 represents an external view of the boiler, while Fig. 2 is a diagrammatic view only of the internal arrangements, and is intended to give an idea of the heating surfaces.

The boiler consists essentially of a series of annular water-chambers of substantially double-conical formation, which are connected together by steam and water-ways. The result of this arrangement is that these several combustion chambers, and that each of the water chambers, with the exception of the outer

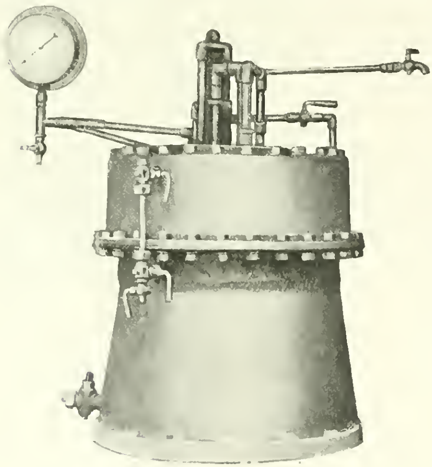


Fig. 1.

one, is fired internally and externally, so that practically the whole of the boiler is heating surface.

The water columns have a distinct narrowing at, or near, the water-line, which, we understand, is for the purpose of reducing the resistance to the heat transmission, as the temperature gradually decreases as the distance from the heating agent increases.

The feed-water to the boiler is taken into a water belt surrounding the upper part of the boiler, communication being set up by small perforations through the boiler shell, at the top and bottom, for the steam and water respectively.

The different chambers have varying heights for the double purpose of giving perfect freedom to the gases at the lower ends of the several cones and to secure an increasing steam space to the inner or central cones previous to the steam entering the superheater.

The superheater is formed of a coil of tubing disposed within the central cone, and in order to protect it from extreme heat provision is made to fill it with water until steam is raised, when, on the water being cut off, the coil immediately assumes the functions of a superheater.

We had the opportunity of seeing the boiler put under steam. The fuel used was ordinary paraffin, and was burnt in an ordinary atmospheric burner. The boiler is of 10-H.P. capacity, and although the boiler

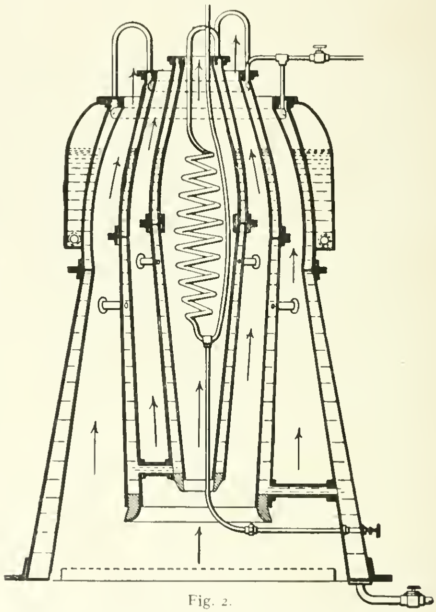


Fig. 2.

and water were quite cold, in $2\frac{1}{4}$ minutes after the burner was lighted steam showed on the gauge and in about 6 minutes 150 lbs. pressure had been reached. The steam was allowed to issue freely into the atmosphere from two $\frac{1}{4}$-inch cocks and cold water was pumped in to keep to water level, the pressure being maintained all the time.

To appreciate the duty of the boiler in comparison with its size we may mention that the diameter is 22 inch at the bottom, 18 inch at the top and 24 inch in height.

We shall look forward with interest to the development of this new design and to the duty per unit of weight and space that can be obtained with it.

An important feature of the boiler is the very limited floor space necessary for the equivalent horse power in the tubulous or Scotch boilers at present in use.

changing taking 20 seconds to accomplish, during which period the lamp is necessarily extinguished. The energy consumption of this lamp is given as 360 watts for 9 ampères, including all losses, while, what is very important, there is a burning life of from 36—40 hours on this system.

Small Motors.

In these days small articles are not infrequently of great value, and the remark may apply to small motors which are arranged in a variety of ways. In one a pinion in the motor shaft gears with a large wheel on the pulley shaft and the whole is self-contained and arranged with a plate for bolting to table or ceiling as required. In another case the motor shaft is extended at each end for buffing and polishing work. Emery wheel grinding is another use in this connection which suggests itself. Portable drilling is a common application of small motors nowadays. There is the hand pattern direct-coupled type, in which an example only weighs 26 lbs., and which any man can easily handle. In another form the motor is portable and a cramp is fitted to the work, the connection being by universal jointing. A unique method of utilizing motors is to have an overhead travelling suspension connected by belt to the ground level where the work has to be done. A still more novel adaptation in this class of work is for the pillars to be magnets with the motor and drill suspended between them. This avoids all cramping as the magnets take their own hold on the work.

Electric Cranes.

This type of crane has seemingly endless possibilities There is not only the magnetic variety which, attached to a traveller, picks up bars and puts them down anywhere within its range, whether hot or cold, but we may have a jib crane and overhead traveller combined by which all motions may be attained and the jib will run into corners, giving therefore, a very wide range and utilizing every inch of space. The operator is, of course, placed opposite to the jib, and he therefore can direct the head in every direction. A similar type to this we have described was used in the construction of the *Mauretania*. The capacity of one is given as 2 tons, with a lifting speed of 15 ft. per minute, the travelling, traversing and slewing speeds being respectively 150, 60 and 180 ft. per minute, the span is given as 25 ft. and four separate motors were used for the motions.

In the first comprehensive Book—Domesday Book—setting forth the statistical condition of England, after the Norman conquest, compiled by command of King William, occurs a reference to a mill in the parish of Harefield, Middlesex. Attracted by the interest which attaches to places with a history, and whose surroundings bid fair to recompense one shut up for the most part amid the bricks and dust of the city and its immediate district, we were tempted to breathe the atmosphere of the neighbourhood where stood, and still stands in part, the mill of the miller who did business in the days when Saxon, Dane and Norman contested for the sovereignty of the land. The vicissitudes of time have not dealt unkindly with the site of the old mill, although it has seen many changes and taken its part in many ways since the landing of the Normans, while within hail of its precincts have echoed the merry-makings of Royalty; for not only is it on record in the local chronicle of events that Queen Elizabeth visited the Parish, but the details of the provender are noted, with the prices of the various articles provided in the days when it was not considered necessary to go so far afield for a Royal bill-of-fare as seems now to be the case for even that of the ordinary breakfast table. The materials were there at hand for the making, the selling and the buying, butter, wheat, chickens, eggs, etc. On the occasion referred to Queen Elizabeth spent two nights at Harefield in 1602. Another item of historical interest is that there is an estate and mansion within the range of the Parish, named Breakspear, from its owner, Nicholas Breakspear, who became Pope Adrian IV. Within the area allotted to the mortal parts of past generations repose the remains of many men who helped to make the historical records which others, succeeding them in the arena of political events, have built upon or marred, and the fifth form schoolboy of the present generation is exercised upon without the fear of condign chastisement, the administration of which was so healthy and exhilarating an exercise for master and pupil in the good old days, when the crime tried at the tribunal of the majority was not that of the teacher for punishing—such was his prerogative—but that of the boy who sought to evade due reward of his misdeeds by dishonour, or who endeavoured to ingratiate himself within the charmed circle by peaching or priggishness, as possibly he attempted to do in later life by pretence and humbug if it were not knocked out of him at school or college. The soil and subsoil of Harefield afford material for the brick-maker and the cement-manufacturer. These are therefore represented in the produce sent out of the land by those whose capital and enterprise have given to the labourer fruit for his labour, and the occasion of hire to many. A valuable bed of chalk lies within the Parish, while water has an underground bed about 100 feet below the surface, the Parish itself being about 290 feet above the sea. Situated on the bank of the Grand Junction Canal is the site of the old mill referred to, and its history is full of interest and mementoes. A deed dated 1370 refers to the mill as belonging to Sir Simon De Swanland, and about 150 years later another deed mentions the building as Cripses Fulling Mill. Two hundred and nineteen years after, it seems that paper and corn were both dealt with at the mill. In 1781 the buildings constituting the mill were let to the Governors of the Mines Royal, and in that letting is mentioned a newly-erected house standing near the mill, now called the Manor House and occupied by the Manager of the present establishment. The Mines Royal converted into copper mills, and very much extended, the original building. This company worked the place for about eighty years with such energy that the name Copper Mills in some degree adheres to them to the present time. The business of the Mines Royal Co. was chiefly to make sheathing for ships' bottoms, after the style of the Muntz metal sheets. In those days commercial competition was not so keen, and the copper used for the purpose was brought from smelting works in Glamorganshire. The output of copper sheets when in full work was about thirty tons per week, and it is a fact worth noting that the Copper Ball of St. Paul's Cathedral was made at these works. The Mines Royal Co. ceased working about 1863, and for several years the mills were in a very neglected state. About 1870 they were taken in hand by Mr. Thomas Newell who converted them again into Paper Mills, and for several years carried on a trade in the manufacture of the finer classes of notepaper and envelopes. He was not however permanently successful and for several years the mills again lapsed into a state of neglect. The United Asbestos Co. took over the mills and the adjacent buildings in 1880, to carry on the manufacture of asbestos goods, since then prosperity and gladness have reigned, the old mill has renewed its youth and the extension of the premises has covered new grounds, thus affording occupation to a larger number of the residents around. The business of manufacturing asbestos from the crude material, has become very important of recent years, entering as it does into so many different spheres of influence in our commercial life, from collieries to steamships. The works of the United Asbestos Co. are thoroughly up-to-date, fitted with the best types of machinery for the various purposes of manufacture, whether for decorative work, into which asbestos now enters largely, and is seen in hotels and mansions, or fire-proof roofs of railway carriages which are constructed of this material; much of this class of work has been done at Harefield. Non-conducting material for keeping heat or cold out or in, to suit the requirements of every possible purchaser, packing or jointing material in endless variety, pleasing to the eye in their excellent finish, and from the care and attention bestowed on the choice of materials and its manufacture from the earliest to the latest stage, the finished article should not only please the eye but satisfy the customer in a more touching way. There is one class of manufacture as a non-conducting covering which this Company has recently commenced to make, and its introduction ought to be a great boon and a great improvement in connection with the covering of deck steam pipes, in preference to the felt and canvas which perish so quickly. The covering in question is made of shredded cork moulded in lengths and in different diameters. There is abundance of water at the works; facility of transport is great by way of the canal which skirts the works; and coal is brought alongside to the bunkers from Warwickshire.

Summary of Shipbuilding Returns of United Kingdom in 1907, arranged in order of Tonnage built by each Firm.

No.	Name of Firm.	Place.	No. of Ships.	Total Tons.†
1	Wm. Doxford & Sons, Ltd. ..	Wear	22	91,254
2	Swan, Hunter, Wigham-Richardson, Ld.	Tyne	19	80,573
3	Sir W. G. Armstrong, Whitworth & Co., Ld.	Tyne	12	74,228
4	Harland & Wolff, Ltd.	Belfast	9	72,412
5	Russell & Co.	Clyde	14	71,705
6	Workman, Clark & Co., Ltd. ..	Belfast	24	63,245
7	Northumberland Shipbuildg Co., Ld.	Tyne	10	48,250
8	J. L. Thompson & Sons, Ltd. ..	Wear	12	48,218
9	Fairfield Shipbuilding Co., Ltd. ..	Clyde	6	48,020
10	Barclay, Curle & Co., Ltd	Clyde	6	47,332
11	Wm. Hamilton & Co., Ltd.	Clyde	10	44,305
12	A. Stephen & Sons, Ltd.	Clyde	7	44,003
13	Chas. Connell & Co., Ltd	Clyde	9	40,298
14	Furness, Withy & Co., Ltd	Hartlepool	9	36,608
15	Sir James Laing & Sons, Ltd. ..	Wear	8	36,017
16	D. & W. Henderson & Co., Ltd ..	Clyde	17	35,886
17	John Brown & Co., Ltd.	Clyde	17	35,293
18	Wm. Denny & Bros.	Clyde		34,418
19	R. Craggs & Sons, Ltd.	Tees	8	34,247
20	Ropner & Son	Tees	9	32,127
21	R. Stephenson & Co., Ltd.	Tyne	8	30,144
22	Sir Raylton Dixon & Co., Ltd. ..	Tees	10	28,380
23	J. Readhead & Sons	Tyne	7	26,139
24	Irvine's Shipbld. & Dry Docks Co., Ld.	Hartlepool	7	25,520
25	Short Bros., Ltd	Wear	6	24,656
26	A. Rodger & Co.	Clyde	8	22,673
27	A. McMillan & Son, Ltd.	Clyde	8	21,918
28	Scott's Shipbld. & Engineering Co., Ld	Clyde	10	20,916
29	Hawthorn, Leslie & Co., Ltd. ..	Tyne	8	20,275
30	Napier & Miller, Ltd.	Clyde	7	19,785
31	Palmer's Shipbuilding & Iron Co. ..	Tyne	7	19,110
32	Craig, Taylor & Co., Ltd	Tees	9	18,880
33	Bartram & Sons	Wear	5	16,778
34	Wm. Beardmore & Co., Ltd. ..	Clyde	3	14,500
35	J. Blumer & Co.	Wear	5	14,063
36	Wood, Skinner & Co., Ltd	Tyne	9	13,915
37	Earle's Shipbuilding & Eng. Co., Ltd.	Humber	22	13,858
38	Osbourne, Graham & Co.	Wear	6	11,437
39	Tyne Iron Shipbuilding Co., Ltd. ..	Tyne	5	11,314
40	S. P. Austin & Son, Ltd.	Wear	7	11,162
41	Clyde Shipbuilding & Engin. Co., Ld.	Clyde	6	10,981
42	Ailsa Shipbuilding	Clyde	22	10,778
43	Wm Dobson & Co.	Tyne	4	10,108
44	Robert Thompson & Sons, Ltd. ..	Wear	6	9,666
45	Fleming & Ferguson	Clyde	11	8,400
46	Smith's Dock Co., Ltd.	N. Shields	36	7,961
47	Caledon Ship & Eng. Co., Ltd. ..	Tay	11	7,942
48	Blyth Shipbuilding Co.	Blyth	7	7,834
49	Sunderland Shipbuilding Co., Ltd...	Wear	3	7,650
50	Murdock & Murray	Clyde	7	6,850
51	Cook, Welton & Gemmell, Ltd. ..	Humber	28	6,712
52	Caird & Co., Ltd.	Clyde	1	6,437
53	Simons & Co., Ltd.	Clyde	13	6,330
54	Gourlay Bros. (Dundee), Ltd. ..	Tay	2	6,276
55	R. Duncan & Co., Ltd.	Clyde	2	5,981
56	Lobnitz & Co.	Clyde	26	5,772
57	Wm. Pickersgill & Sons	Wear	3	5,678
58	Cammell, Laird & Co., Ltd... ..	Mersey	6	5,591
59	London & Glasgow Shipbuilding Co.	Clyde	1	5,580
60	Ramage & Ferguson, Ltd.	Forth	6	5,545
61	Cochrane & Sons	Humber	31	5,517
62	John Crown & Sons, Ltd.	Wear	5	5,274
63	Vickers, Sons & Maxim, Ltd. ..	Barrow	—	4,882
64	Mackay Bros.	—	4	4,607
65	Ferguson Bros...		6	4,500
66	Hall, Russell & Co.	Aberdeen	28	4,416
67	A. W. Robertson & Co	Thames	21	4,074
68	Mackie and Thompson	Clyde	26	3,663
69	Goole Shipbuilding & Repg. Co., Ld.	Goole	14	3,594
70	A. & J. Inglis, Ltd.	Clyde	2	3,503
*1	Wm. Gray & Co., Ltd.	Hartlepool	13	47,918
*2	Richardson, Duck & Co.	Tees	13	32,204
*3	Grangemouth & Greenock Dock-yard Co.	Clyde	13	22,253

† Board of Trade gross tons register.
* Board of Trade gross tons register including erections

List of Vessels Launched in 1907.

ENGLISH.

THE TYNE, &c.

By Sir W. G. Armstrong, Whitworth & Co., Ltd., Elswick Works, Newcastle-on-Tyne.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect	I.H.P.
Katuna	Steel	British	4,641	—	3,000
Karonga	,,	,,	4,665	—	3,000
Kabinga	,,	,,	4,658	—	3,000
Kasenga	,,	,,	4,652	—	3,000
Tarmo	,,	Foreign	1,574	—	3,850
Sebara	,,	,,	4,658	—	3,000
Oberon	,,	British	4,895	—	2,750
Buyo Maru ..	,,	Foreign	4,820	—	3,000
Derbent	,,	,,	3,020	—	1,850
H.M.S. Afridi ..	,,	British	795	—	14,250
H.M.S. Invincible	,,	,,	17,250	—	—
H.M.S. Superb	,,	,,	18,600	—	23,000

By The Blyth Shipbuilding Co., Ltd., Blyth.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect	I.H.P.
† Ludworth ..	Steel	British	1,301	—	850
† Thornley	,,	,,	1,327	—	950
† Ryhope	,,	,,	1,334	—	950
Rock Breaking Barge, No. 2 ..	,,	,,	184	—	—
† Elterwater ..	,,	,,	1,228	—	995
† Blackwood ..	,,	,,	1,230	—	995
† Redwood	,,	,,	1,230	—	995

By Wm. Dobson & Co., Walker, Newcastle-on-Tyne.

Total gross tonnage .. .. .. 10,108 tons.
Engines.. .. .. 6,050 I.H.P.

By Joseph T. Eltringham & Co., South Shields.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect	I.H.P.
† Fane	Steel Trawler	British	269	—	450
Acton Grange ..	Steel Paddle Tug	,,	156	—	400
† Herald	Steel Trawler	,,	387	—	800
* Uberous	Steel Drifter	,,	97	—	120
Old Trafford ..	Steel Paddle Tug	,,	156	—	400
† Beluga	Steel Trawler	Foreign	390	—	800

By R. & W. Hawthorn, Leslie & Co., Ltd., Hebburn-on-Tyne.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect	I.H.P.
t H.M.S. Ghurka	—	British	890dis.	890	14,250
Beshtau	—	Foreign	1,076	1,098	700
Dichtau	—	,,	1,075	1,097	700
Tasmanic	—	,,	4,010	5,190	2,750
t Torpedo Boat, No. 21		British	280dis.	280	4,000
Port Pirie.. ..	—	,,	4,068	5,167	2,750
Australic	—	Foreign	4,009	5,190	2,750
Holywell	—	British	4,867	5,227	3,150

By Hepple & Co., Ltd., Wapping Street, South Shields.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect	I.H.P.
* No. 565	Steel Ketch	Foreign	160	198	350
Lumley	Steel	British	122	136	425
* Test	,,	,,	84	91	250
* Glencona	,,	,,	240	282	360
* Loris	,,	Foreign	26	30	160

By W. P. Huntley, Slipway, Hebburn-on-Tyne.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect	I.H.P.
Florence	Lighter	British	40	—	—
Derwent Water	,,	,,	40	—	—

* Compound. † Triple. *t* Turbine.

By The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne.

Name of Vessel	Built of	Owners.	G.T Regis.	G.T inclu erect	I.H.P.
Norfolk	—	British	4,300	—	1,900
Rotterdam ..	—	..	6,300	—	3,200
Canterbury ..	—	..	4,740	—	2,350
Netherlee	—	..	4,740	—	2,000
Queen Elizabeth	—	..	4,740	—	2,000
Flodden	—	..	4,740	—	2,000
Belle of Spain ..	—	..	4,740	—	2,000
Ross	—	,,	2,940	—	1,700
———	—	—	6,270	—	3,300
Graciana	—	British	4,740	—	2,000

By Palmer's Shipbuilding and Iron Co., Ltd., Jarrow-on-Tyne.

Name of Vessel	Built of	Owners.	G.T Regis.	G.T inclu erect	I.H.P.
Motor	Steel Lighter	British	313	313	130
Meinam	Steel Cargo	Foreign	5,456	6,110	3,200
Easington.. ..	,,	British	1,386	1,386	980
Frances Duncan	,,	,,	2,383	2,547	2,500
Norse Prince ..	,,	..	5,611	7,029	3,000
Richard Welford	Steel Pass.	..	1,297	1,576	2,380
Beazley	Steel Cargo	..	2,661	2,903	1,240
Vessel Engined only		—	—	—	1,900
,, ,,		—	—	—	3,200

By John Readhead & Sons, West Docks, South Shields.

Name of Vessel	Built of	Owners.	G.T Regis.	G.T inclu erect	I.H.P.
Trecarrell ..	—	British	3,875	4,209	2,000
Trevince ..	—	,,	3,874	4,208	2,000
Dan	—	Foreign	3,628	4,252	1,750
Muirfield	—	British	3,086	3,688	1,700
Spheroid	—	..	3,815	4,450	2,500
Harport	—	,,	3,986	4,891	2,200
Gordonia	—	,,	3,875	4,209	2,000

By J. P. Rennoldson & Sons, South Shields.

Name of Vessel	Built of	Owners.	G.T Regis.	G.T inclu erect	I.H.P.
† Hercule	Steel	Foreign	604	—	2,950
††Abeille XI. ..	..	,,	285	—	876
* Old Quay ..	,,	British	119	—	511
* Protector	,,	..	199	—	325
††John Dent ..	,,	..	44	—	120
* Salvage	,,	,,	110	—	407

By R. Stephenson & Co., Ltd., Hebburn-on-Tyne.

Name of Vessel	Built of	Owners.	G.T Regis.	G.T inclu erect	I.H.P.
† River Forth	Steel	British	4,413	4,413	1,400
† Crossby ..	..	,,	3,893	3,893	1,300
† Derwenthall ..	..	,,	3,905	3,905	1,950
† Marina	,,	Foreign	2,852	2,852	1,400
† Kathleen	,,	British	3,908	3,908	1,350
† Nora	,,	..	3,908	3,908	1,350
† Stella	,,	Foreign	2,852	2,852	1,450
† No. 113	,,	—	4,413	4,413	1,000

By Tyne Iron Shipbuilding Co., Ltd., Wellington Quay-on-Tyne.

Name of Vessel	Built of	Owners.	G.T Regis.	G.T inclu erect	I.H.P.
† Badagri . .	Steel	British	2,952		1,870
† Carbineer . ..	..	.	1,266		950
† Fram..	..	Foreign	2,750	13,400	1,650
† Musketeer.. ..	..	British	1,266		950
† Not named ..	..	—	3,080		1,850

By Wood, Skinner & Co., Ltd., Bill Quay, Newcastle-on-Tyne.

Name of Vessel	Built of	Owners.	G.T Regis.	G.T inclu erect	I.H.P.
† Daisy	Steel Schooner	Foreign	1,209	—	900
† Anine	..	..	1,299	—	900
† Hestia	.	,,	1,265	—	870
† Delia	..	,	1,267	—	870
† Burnhope ..	,,	British	1,941	—	1,300
† Elfrida	..	..	2,624	—	1,700
† Hebburn	,,	..	1,941	—	1,300
† Sofie	,,	..	354	—	400
† Flora	Steel	Foreign	2,015	—	1,350

* Compound. † Triple. †† Twin Compound.

By Smith's Dock Co., Ltd., North Shields.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T inclu. erect	I.H.P.
801	Steel Screw	—	216	—	400
810 and 811 ..	,,	—	259ea	..	450ea
816, 363, 364, 365	,,	—	240ea	—	400ea
338	,,	—	269	—	460
339	,,	—	288	—	500
340	,	—	300	—	450
341	,,	—	172	—	400
342	,,	—	96	—	190
343, 345, 346, 347	..	—	91ea	—	190ea
344	,,	—	90	—	190
348, 349	,,	—	252ea	—	400ea
350	,,	—	252	—	470
351	,,	—	255	—	400
352 and 353 ..	..	—	270ea		400ea
354	..	—	258	—	425
355	,,	—	292	—	500
356	,,	—	232	—	400
357	..	—	235	—	400
358	..	—	239	—	450
359	,,	—	239	—	380
360 and 361 ..	..	—	240ea		380ea
362	..	—	239		450
366	..	—	232	—	400
367	..	—	171	—	400
368 and 369 ..	,,	—	260ea	—	425ea

By Swan, Hunter & Wigham Richardson, Ltd., Wallsend and Walker-on-Tyne.

Name of Vessel	Built of	Owners.	G.T Regis.	G.T inclu erect	I.H.P.
† Venezia	—	Foreign	6,854	—	7,200
† Komata ..	—	British	2,202	—	1,500
† Waikora	—	,,	5,066	—	2,300
† Lowenburg ..	—	Foreign	5,257	—	2,300
† Ganelon	—	,,	6,420	—	3,600
††Regulus	—	British	641	—	800
† Worms	—	Foreign	5,613	—	3,200
† Guardian	—	British	1,827	—	1,800
† Benin	—	,,	4,737	—	2,500
† Annetta	—	,,	1,294	—	1,650
† Whimbrel ..	—	,,	2,006	—	1,500
† Reina Victoria..	—	Foreign	1,272	—	1,400
† Malte	—	,,	8,674	—	7,500
† Guyane	—	,,	3,003	—	1,700
† Ceylon	—	,,	8,693	—	7,500
Trinidad Dock..	—	British	3,450	—	—
Rotterdam Dock	—	Foreign	5,710	—	—
† Empress of Midland	—	British	2,224	—	1,050
† Afrique	—	Foreign	5,630	—	6,750

THE WEAR, &c.

By S. P. Austin & Son, Ltd., Wear Dockyard, Sunderland.

Name of Vessel	Built of	Owners	G.T Regis.	G.T inclu. erect.	I.H.P.
**Tweed	Steel s.s.	British	1,777		1,100
**President	,,	,,	1,945	—	1,200
**Fleetwing ..	,,	,,	1,351		1,045
**Heimdal	,,	Foreign	1,120		865
**Excellent	,,	British	1,944	—	1,200
**Vikingen	,,	Foreign	2,380	—	1,435
**John Miles ..	,,	British	645		705

By Bartram & Sons, South Dock, Sunderland.

Name of Vessel	Built of	Owners	G.T Regis.	G.T inclu. erect.	I.H.P.
† Cronstadt ..	Steel Schooner	British	1,673	—	1,000
† Manoravon ..	,,	,,	3,710		1,840
† Kingsway ..	..	,,	3,647		1,890
† Baltic Exchange	,,	,,	3,676		1,890
† Bendoran ..	..	,,	4,070	—	2,000

By John Blumer & Co., North Dock, Sunderland.

Name of Vessel	Built of	Owners	G.T Regis.	G.T inclu. erect.	I.H.P.
Duke of York	Steel	British	3,181	3,439	1,730
Kristiania..	,,	Foreign	2,686	3,125	1,635
Carisbrook	,,	British	2,351	2,585	1,420
Akershus ..	,,	Foreign	2,697	3,130	1,595
Portreath ..	,,	British	3,148	3,463	1,770

† Triple. †† Twin Compound. ** Triple Compound.

By John Crown & Sons, Ltd., Strand Slipway, Sunderland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G T inclu erect	I H P
† Tees	Steel	British	1,388	—	—
† Dagenham ..	,,	,,	1,466	—	—
† Whorlton	,,	,,	1,468	—	—
† Knottingley ..	,,	,,	824	—	—
* Grappler	,,	,,	128	—	—

By Wm. Doxford & Sons, Ltd., Pallion Yard, Sunderland.

† Braziliana ..	Steel	British	3,827	—	1,526
† Claveresk	,,	,,	3,829	—	1,526
† Blötberg	,,	Foreign	4,800	—	2,188
† Galavale	,,	British	3,830	—	1,526
† Admiraal de Ruijter	,,	Foreign	5,396	—	2,188
† Clintonia	,,	British	3,830	—	1,473
† Claverley	,,	,,	3,829	—	1,526
† Garfield	,,	,,	3,838	—	1,473
† Redbridge ..	,,	,,	3,834	—	1,526
† Vesterland ..	,,	Foreign	3,846	—	1,526
† Silksworth Hall	,,	British	4,777	—	1,624
† Fife	,,	,,	3,918	—	1,459
† Clan Graham ..	,,	,,	5,213	—	2,772
† Duffryn Manor .	,,	,,	3,952	—	1,516
† Clan Sinclair ..	,,	,,	5,215	—	2,772
† Garryvale ..	,,	,,	3,908	—	1,473
† Clan Buchanan .	,,	,,	5,213	—	2,772
† Lady Carrington	,,	,,	3,920	—	1,624
† Walhalla	,,	Foreign	3,928	—	1,989
† Koromiko.. ..	,,	British	2,479	—	1,606
† Wotan	,,	Foreign	3,936	—	1,989
† Walküre	,,	,,	3,936	—	1,989

By Sir James Laing & Sons, Ltd., Deptford Yard, Sunderland.

San Giorgio ..	—	—	6,391	6,688	4,500
San Giovanni ..	—	—	6,592	6,984	5,300
Regina D'Italia	—	—	6,594	6,904	5,250
Principe di Piemonte	—	—	6,595	6,904	5,250
Guiana	—	—	3,656	3,971	2,700
Agadir	—	—	2,722	2,878	2,350
Arzila	—	—	2,721	2,878	2,350
Small craft not named	—	—	742	742	—

By Osbourne, Graham & Co., North Hylton, Sunderland.

† Norman	Steel	Foreign	1,866	—	1,130
† Annette Furness	,,	,,	1,871	—	1,130
† Wychwood ..	,,	British	1,985	—	1,195
† Ladywood ..	,,	,,	1,983	—	1,195
† Thimbleby ..	,,	,,	1,865	—	1,100
† Grartley ..	,,	,,	1,867	—	1,100

By Wm. Pickersgill & Sons, Sunderland.

Saint Michael ..	—	British	3,796	—	—
Saltmarshe ..	—	,,	930	—	—
Hessle	—	,,	952	—	—

By Short Bros., Ltd., Sunderland.

Eugene S. Embiricos	—	Foreign	4,237	5,331	1,620
Lovland	—	,,	2,346	2,703	1,290
Anglo-Colombian	—	British	4,791	6,086	3,150
Constantinos Bebis	—	Foreign	2,931	3,702	1,300
Royal Prince ..	—	British	5,546	7,068	3,500
Anglo-Mexican	—	,,	4,802	6,001	3,150

By Sunderland Shipbuilding Co., Ltd., South Dock, Sunderland.

Leif ..	Steel	Foreign	2,139	—	1,435
Ocland	,,	,,	3,191	—	1,775
Dunelm		British	2,318	—	1,380

* Compound. † Triple.

By R. Thompson & Sons, Ltd., Southwick Yard, Sunderland.

Name of Vessel.	Built of	Owners	G T Regis.	G T inclu erect	I H P.
† Snestad	Steel	Foreign	2,360	2,670	1,000
† Antinous	,,	British	3,682	4,106	1,250
† Wyoming and Idaho	,,	,,	597ea	614ea	500ea
† Arizona	,,	,,	602	619	500
† Karanja	,,	,,	1,828	1,908	700

By Joseph L. Thompson & Sons, Ltd., Sunderland.

Moorgate	—	British	3,785	4,375	2,100
Eir	—	Foreign	3,805	4,400	2,100
Bratsberg ..	—	,,	3,838	4,428	2,100
Corfu..	—	British	3,695	4,305	1,840
River Plate ..	—	,,	3,660	4,270	1,840
Zermatt	—	,,	3,767	4,588	2,000
Arnell	—	,,	3,813	4,408	2,100
Kossuth Ferencz ..		Foreign	4,804	5,056	2,200
Morawitz	—	,,	4,800	5,052	2,200
Keyingham ..	—	British*	3,695	4,305	1,800
Zanoni	—	,,	3,844	4,444	1,960
Blackwell ..	—	,,	4,712	5,435	3,150

THE TEES, HARTLEPOOLS, &c.

By R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough.

Name of Vessel	Built of	Owners.	G T Regis	G T. inclu erect.	I.H P.
Fitzclarence ..	—	British	4,476	—	2,400
Fitzpatrick ..	—	,,	4,485	—	2,400
Transport ..	—	,,	3,928	—	1,700
Eleni Stathatos	—	Foreign	3,631	—	1,700
Turul	—	,,	3,900	—	2,000
Orsova	—	,,	3,893	—	2,000
Lynrowan ..	—	British	4,414	—	1,800
Dacre Castle ..	—	,,	5,520	—	2,500

By Craig, Taylor & Co., Ltd., Stockton-on-Tees.

† Acre	3-deck passenger str.	Foreign	2,590	—	2,300
† Elisabeth	Single deck	,,	2,020	—	1,025
† Whitewood ..	,,	British	1,290	—	995
† Antinoe	,,	,,	3,020	—	1,455
† Baltic Sea ..	,,	,,	2,390	—	1,280
† Helena	,,	Foreign	2,020	—	1,025
† Cubatao	,,	,,	1,850	—	1,200
† Ibiapaba	,,	,,	1,850	—	1,200
† Borborema ..	,,	,,	1,850	—	1,200

By W. Gray & Co., Ltd., West Hartlepool.

Szterenyi	—	Foreign	—	3,707	1,700
Magyarorszag ..	—	,,	—	3,702	1,700
Grof Serenyi Bela	—	,,	—	3,703	1,700
Pollacsek	—	,,	—	3,700	1,700
Despina G. Michalinos	—	,,	—	3,487	1,500
Frixos	—	British	—	4,292	2,000
Hartington ..	—	,,	—	5,017	2,000
Welbury	—	,,	—	3,935	1,700
Ivar	—	Foreign	—	2,399	1,250
Maylands	—	British	—	4,249	2,000
No. 751	—	—	—	3,543	1,400
Selja	—	Foreign	—	4,864	2,000
Whitby Abbey	—	British	—	1,320	3,400

By Furness, Withy & Co. Ltd., Hartlepool.

No. 300	Steam	British	4,807	—	—
No. 301	,,	,,	2,266	—	—
No. 302	,,	Foreign	6,042	—	—
No. 303	,,	British	3,856	—	—
No. 304	,,	,,	3,880	—	—
No. 305	,,	,,	3,907	—	—
Nos. 306, 307 and 308	,,	Foreign	3,950ea	—	—

† Triple.

By Wm. Harkess & Sons, Middlesbrough.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
* Lagos and Forcados	Steel	British	392ea	—	580ea
† Sussex Coast	,,	,,	641	—	600
† Ford	,,	Foreign	1,327	—	1,005
† Cedarwood	,,	British	620	—	500

By Sir Raylton Dixon & Co., Ltd., Middlesbrough-on-Tees.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
* Sygna	Steel Steam	Foreign	3,881	4,900	2,645
* Period	,,	British	2,786	3,000	1,800
* Ellen	,,	Foreign	3,877	4,680	2,515
* Kronprins Olav	,,	,,	3,924	4,570	2,515
Ambriz	,,	,,	859	910	690
* Echunga	,,	British	4,589	5,850	3,200
* Urilla	,,	,,	1,965	2,200	1,450
Crispin	,,	,,	3,694	4,810	3,000
Ibo	,,	Foreign	835	880	520
* Westwood	,,	British	1,970	2,200	1,200

By Richardson, Duck & Co., South Stockton Iron Shipyard, Stockton-on-Tees.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
Washington ..	Steamer	British	—	5,470	2,200
Llongwen ..	,,	,,	—	5,145	1,950
6 Lighters, shipped abroad in pieces				426	—
Lady Lewis ..	Steamer	British	—	4,657	2,540
Vittoria	,,	,,	—	3,269	1,400
New York City	,,	,,	—	3,636	2,000
Snowdonian ..	,,	,,	—	4,663	1,700
Bilbster	,,	,,	—	4,938	1,900

By Ropner & Sons, Limited, Stockton-on-Tees.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
Oiz Mendi ..	—	Foreign	2,092	—	1,250
† Alu Mendi ..	—	,,	2,095	—	1,250
† Cardigan	—	British	4,295	—	2,250
† Ingleby	—	,,	3,815	—	1,950
† Coleby	—	,,	3,824	—	1,950
† Thor	—	Foreign	4,849	—	2,250
† Margam Abbey	—	,,	4,471	—	2,200
† Harlseywood ..	—	British	2,861	—	1,500
† Romanby ..	—	,,é	3,825	—	1,950

By Irvine's Shipbuilding & Dry Dock Co., Ltd., West Hartlepool.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
Richmond ..	—	—	3,860	—	1,600
Abonema	—	—	3,930	—	1,750
Washington ..	—	—	3,450	—	1,550
Newport News ..	—	—	3,460	—	1,550
Palma	—	—	3,935	—	1,750
Arabiana	—	—	3,425	—	1,550
Tuscany	—	—	3,460	—	1,550

THE HUMBER, &c.

By Cochrane & Sons, Ouse Shipbuilding Yard, Selby.

Name of Vessel.	Built of	Owners.	G.T. Regis	G.T. inclu erect	I.H.P.
Cleon	Steel Trawler	British	266	—	480
3 Trawlers ..	,,	,,	275ea	—	420ea
Marcelle	,,	Foreign	217	—	450
Vine	Steel Drifter	British	95	—	200
2 Drifters ..	,,	British	81ea	—	175ea
Southward ..	Steel Trawler		225	—	450
Tokio .. .			295	—	540
Indian Empire	.	.	288	—	520
8 Drifters	Steel	..	88ea	—	175ea
Fraserburgh ..	,,		82	—	200
Marlborough and Rose	Steel Trawler	..	212ea	—	430ea
Othello		..	201	—	430
4 Trawlers ..	..	.	184ea	—	375ea
Dewsland	.		236	—	420
Gloria			263	—	420
Avon	.		263	—	250
Pekin	.	..	225	—	430

* Compound. † Triple.

By Cook, Welton & Gemmell, Ltd., Beverley.

Name of Vessel.	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
Touchstone ..	Steel Trawler	British	173	—	280
Agile	,,		245	—	450
St. Lucia and St. Vincent	..		185ea	—	300ea
Fraser	..	,,	310	—	500
Federal and Renown	,,	,,	243ea	—	450ea
Princesse Marie-José	.	Foreign	270	—	450
Eros	..	British	286	—	500
Sanson	..	,,	230	—	430
Roman	..	.	356	—	700
Staunton		,	282	—	500
Royallieu		,,	210	—	450
Revigo and Reperio and Rideo	,,	,,	230ea	—	450ea
Claire & Grenada	,,	,,	218ea	—	430ea
Vera	,,	,,	333	—	530
Othello and Iago	.	,,	205ea	—	300ea
Saxon	,,	,,	346	—	600
Semiramis ..	,,	,,	246	—	450
Mopsa	,,	,,	205	—	300
Penguin and Sea-Gull	,,	,,	243ea	—	440ea
No. 160	,,	,,	286	—	500
Hatfield	Steel Waterboat	,,	42	—	30

By Thomas Dobson & Co., Hessle Haven.

Name of Vessel.	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
Missionero ..	Twin-Screw Passenger Steamer	Foreign	385	—	395
Maria Luisa ..	Schooner	,,	380	—	—
Xingu .. / Arinos ..	Barges for Meat Trade	Foreign	100 approx. not measured.		
Guapore	Tug	,,	63 approx. not measured.		95
Olive .. / Howard .. / Lapwing ..	Steel Lighters	British	485	—	—

By Earle's Shipbuilding & Engineering Co., Ltd., Hull.

Name of Vessel.	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
Onward Ho ..	—	British	323	—	Hull only
Kovno	—	,,	1,985	—	1,850
Barbados and Grenada ..	—	,,	183ea	—	350ea
Barges (7) ..	—	Foreign	137 (total))		—
Tosno	—	British	2,000	—	1,850
Celtic	—	,,	264	—	460
Newmarket ..	—	,,	833	—	2,000
Lord Roberts ..	—	,,	293	—	500
Buffalo	—	,,	5,000	—	2,000
Marjorie	—	,,	294	—	550
Lark	—	..	280	—	550
Botanic and Coltman ..	—		312ea	—	600ea
Rievaulx Abbey	—		1,210	—	3,000
Freire de Andrade		Foreign	240	—	350
Machinery for Renewals and vessels built elsewhere					11,120

By Goole Shipbuilding and Repairing Co. Ltd., Victoria Shipyard, Goole.

Name of Vessel.	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
† Phœbe .	Steel	British	279	—	420
† Swan ..	..	,,	270	—	450
† Vinca	—	,,	300	—	470
† Orphesia	..	,	273	—	480
† Tern and Redcap			109ea	—	300ea
† Argon .. .			226	—	400
† Trogan	.	.	182		300
† Cottingham .	.	.	513	—	450
† Lizzie and Ethel		,,	278ea	—	420ea
† Buzzard, Puffin and Willett		..	190ea	—	300ea

† Triple.

By J. Scarr & Son, Beverley and Howden, Yorks.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I H P.
Kitty	Steel	British	200	—	—
Barbara and Vera	,,	,,	Carrying cap. 260ea	—	—
Steam Dredger	,,	,,	—	—	—
Beverley Yard.					
Lighter	Steel	British	180	—	—
,,	,,	,,	350	—	—
Keel	,,	,,	130	—	—
Keel	,,	,,	130	—	—

By Henry Scarr, Haven Shipyard, Hessle, Hull.

Beta	Steel Barge	British	190	—	—
Ernest	,,	,,	230	—	—
Ouse	Set frames	..	—	—	—
Lord Beresford and Enid	Steel Barges	British	185ea	—	—
* Yeoman	Twin-Screw Steel Tug	,,	90	—	200
————	Steel Barge	,,	65	—	—

By W. H. Warren, New Holland.

Nancy	Steel Sloop	British	160	—	—
Phyllis	,,	,,	170	—	—
Osprey and Puffin	Steel Lighters	,,	260ea	—	—
Quail and Raven	Steel	,,	285ea	—	—
Tug	—	—	80	—	—

THE THAMES, &c.

By Beeching Bros., Ltd., Gt. Yarmouth.

Name of Vessel	Built of	Owners	G.T. Regis.	G T inclu. erect	I H P
* 3 Drifters	Wood	British	90ea	—	140ea
* Sphinx	Steam Drifter	,,	77	—	135
† Selina	,,	,,	98	—	250
* Radiant and Boy Arthur	,,	,,	95ea	—	140ea
* Hope	,,	,,	92	—	160

By Edwards & Co., Ltd., Millwall, E.

No. 570	Steel Pontoon	Foreign	169	—	—
‡‡No. 571	Steel Tug	,,	29	—	120
‡‡No. 572	Steel Ferry	,,	40	—	110
† Nos. 573, 574 and 575	,, tugs	,,	50ea	—	300ea
‡‡Leopard	,, ,,	British	43	—	200
577	Steel yacht	Foreign	69	—	150
‡‡578	Steel launch	,,	8	—	25
579	Steel Hopper Dredger	,,	77	—	—
‡‡580	Steel Passenger Steamer	,,	184	—	330
582/3	Steel Grab Dredger	British	24	—	—

By Fellows & Co., Ltd., Yarmouth.

Rose	Wood Steam Drifter	—	81	—	—
Condor	Steel Lighter	—	—	—	—
Heron	,,	—	—	—	—
Frin and Masterpiece	Wood St. Drifter	—	81ea	—	—
Mary's & Amity	,,	—	81ea	—	
Active	,,	—	80	—	—
Resolute	,,	—	82	—	—
No. 2[illegible]6	,,	—	—	—	—

* Compound. † Triple. ‡‡ Twin Compound.

By Forrestt & Co., Ltd., Wyvenhoe.

Name of Vessel.	Built of	Owners	G.T. Regis	G.T. inclu. erect.	I.H P.
* Gambia	Wood	British	13	—	45
* Vulture	Steel	,,	35	—	135
* 2 Steam Launches	,,	Foreign	28	—	100
* Steam Cutter	Wood	,,	6	—	25
Motor Launch	,,	,,	7	—	15bhp
* Iguassu Steamer	Steel	,,	187	—	200
* Albatroz	,,	,,	81	—	360
* Hospital Launch	,,	,,	45	—	100
* 2 Steam Launches	,,	British	76	—	—
Canoe	,,	,,	9	—	—
Sternwheel Motor Launch	,,	Foreign	19	—	26bhp
* 2 Steam Pinnaces	Wood	British	30	—	150
* Steam Barge	,,	,,	11	—	75
Motor Launch	,,	,,	1	—	3bhp
Canoes	Steel	,,	10	—	—
Rowing Pinnace	Steel	,,	4	—	—
Canoe	,,	,,	4	—	—
* Steam Launch	Wood	Foreign	4	—	25
"Crane" Steam Launch	Steel	British	23	—	70
Operating Tube Tug	,,	,,	20	—	—
4 Barges	,,	,,	200	—	—

By R. & H. Green, Ltd., Blackwall, E.

6 Barges	Steel	—	92ea	—	—
Anchor Boat	—	—	18	—	—

By G. Rennie & Co., Thames Street, Greenwich.

		tons disp.		
Sudan	Stern Wheel Steamer	264	—	600
Omdurman	,, ,,	160	—	350
No. 1062	Twin-screw Tug	103	—	200
No. 1064	,, ,,	121	—	210
No. 1063	Lightship Tender	170	—	120
Furnas	Screw Pilot Boat	110	—	208
Azinheira	Screw Tug	80	—	185
Generale	Twin Screw	75	—	280
No. 1056	Tug	40	—	75
No. 1061	Steam Vechicuary Ferry Boat	150	—	120
Clayton, Nos. 1, 2, 3 and 4	Single Screw	65ea	—	110ea
No. 1055	Oil Tank Steamer	250	—	80
No. 1065	Steel Lighter	240	—	—
Nos. 1070, 1071 and 1072	Steel Troop Lighters	130ea	—	—
No. 1068	Grab Dredger	110	—	—

By H. Reynolds & Son, Lowestoft.

m Thankful	Wood Ketch	British	56	—	—
* Water Lily and Victory	,,	,,	81ea	—	130ab
* Beneficent	,,	,,	81	—	130
* 5 Vessels	,,	,,	81ea	—	130ea
* Hearty	,,	,,	82	—	130
* Dove	,,	,,	80	—	130
* Jeannie Simpson	,,	,,	90	—	220ab
* Laburnum and Ivy	,,	,,	81ea	—	120ea
* Annie Smith	,,	,,	83	—	120

By A. W. Robertson & Co., Lea Shipbuilding Yard, Canning Town, E.

19 Lighters	Steel	—	2,974	—	-
1 Passenger Str.	,,	Foreign	100	—	110
1 Floating Dock	,,	,,	1000	—	-

By H. Shrubsall, Tunnel Wharf, East Greenwich, S.E.

Varuna	Wood Sailing Barge	British	76	76	—

m Motor. * Compound.

By The Thames Ironworks Shipbuilding and Engineering Co., Ltd., Orchard Yard, Blackwall, E.

Name of Vessel	Built of	Owners.	G T Regis	G T inclu erect	I H P
L. 26A	Steel	—	154	—	400
‡‡L. 26B			154		400

By John Chambers, North Side Harbour, Lowestoft.

† Vigilant	Steam Drifter	British	87	—	200
† 3 Drifters ..	,,	,,	89ea	—	200ea
* 3 Drifters ..	,,	,,	87ea	—	170ea
* Primrose		,,	62	—	100
* Mascot	,,		62	—	100
† G. M. V.			93	—	200
* 3 Drifters ..			61ea	—	100ea
† Boy Charley ..	,,		83	—	200
* Scotsman			88	—	200
† Arimathea ..		,,	87	—	200
Ocean Spray ..			62	—	100
Silverdale ..			62		100
4 Trawlers ..	Sailing		55ea	—	—
2 Trawlers ..	,,		56ea	—	—
No. 308	Steam Drifter		62		100

By Yarrow & Co., Ltd., Poplar, London, E.

Vessel	Owners.	G T Regis.	I H P
2 Raised Propeller Boats for river service, 97½' × 28'	Foreign	98	250
1 Shallow Draught Twin-screw river launch, 85' × 16'	,,	42	70
1 Shallow Draught Single-screw Raised Propeller river launch, 75' × 9'		21	35
2 Shallow Draught Raised Propeller river gunboats, 75' × 9½' ..	,,	21	35
1 Launch Hull, for river work, 60' × 8', no machinery fitted ..	British	12	—
2 Sternwheel river Steamers, with compound surface condensing engines, 132' × 31'	Foreign	160	250
1 High speed Despatch Boat, 60' × 9½'	,,	16	250
2 Torpedo Boat Destroyers, 220' by 20½', twin screw	,,	270	7,500
1 Raised Propeller river launch 53' × 7'		7	20
2 First class Torpedo Boats, with turbine machinery	British	210	3,750
1 First-class Torpedo Boat, with turbine machinery		216	4,000

N.B.—All the above vessels are built of steel and gross tonnage approx.

ENGLISH CHANNEL.

By R. Cock & Sons, Quay, Appledore, R.S.O., Devon.

Name of Vessel	Built of	Owners	G T Regis	G T inclu erect	I H P
Roy	Steel Tug	British	26	—	—
* Provider	Steel Fishing Drifter	,,		—	

2 Steel River Barges (For shipment abroad).

By Cox & Co., Falmouth.

* 118 War Depart. Steamer	British	not measured		250
* 119 War Depart.	,,			270
* 120 Twin Screw Pass.		67		220
* 121 Single Screw Tug ..		34		150
* 122 Paddle Pass.		71		105
* 123 Pass. & Cargo	,,	127	—	250
* 125 Customs Launch ..		not measured		75

By R. Kitto & Son, Porthleven.

7 Drifters	—	520	—	—
2 Smacks .	—	80	—	—

* Compound. † Triple. ‡‡ Twin Compound.

By John Thomas Crampton, Albion Shipyard, Landport.

Name of Vessel	Built of	Owners	G T Regis.	G T inclu erect	I.H P
2 Powder Barges	Sail	—	—	140	
1 Coal Barge .	Dumb	—	—	320	—
45 ft Motor Boat	Screw		-	15	100HP
50 Floating Stages and Pontoons	—		—	500	—
20 Boats (various)			—	150	

By J. G. Fay & Co., Ltd., Southampton.

Bana	Wood Cutter	Foreign	6	—	—
Thalassa . .	Wood Yawl	British	16		

By Hartley Mead, East Cowes.

m Devil Fish Aux	Wood Yawl	British	4	—	5
m Yacht's Launch	Wood	—	4	—	6
m ,,	,,	—	4	-	6½

By G. Napier & Sons, Cross House Engineering Works, Southampton.

* Silverio Neri .	Steel	Foreign	[illegible]	—	[illegible]

By Geo. & Thos. Smith, Ltd., Rock Channel, Rye, Sussex.

4 Vessels .	Wood	British	40ea	59ea	—
Alert	,,	,,	59	59	

By John I. Thornycroft & Co., Ltd., Woolston Works, Southampton.

† Egypt (P.S.) ..	Steel	Foreign	500		500
t Tartar (Ocean going Destroyer)	,,	British	750	—	14,500
† Amapa (Cruiser Yacht)	,,	Foreign	178		500
* Rio Grande (Tug)	,,	,	98	—	300
* 6 Launches ..	Wood	,,	120	—	525
t 2 First class Torpedo Boats ..	Steel	British	250ea	—	4,000ea
* Launch	Wood	Foreign	15	—	45
p Swietlana (Yacht)	Steel	,	40	—	100
2 Barges	,,	,,	60	—	-
* Sternwheel Vessel	,,	,,	90	—	100

Built at Church Wharf, Chiswick.

t 2 First-class Torpedo Boats ..	Steel	British	250ea	—	4,000ea

By Philip & Son, Ltd., Dartmouth

* Hercules	Steel	British	[illegible]	—	400
* 2 Admiralty steam Barges	Wood		20ea	—	80ea
* Cora	,,	Foreign	30	—	80
* Cholchol	,,	..	30	—	80
* Viking	,,		25	—	60
* Ventura	..	..	30	—	80
† Try Again ..	Steel	British	[illegible]	—	[illegible]
* Sonsonate	Wood	Foreign	40	—	85
† James Fletcher .	Steel	British	270	—	[illegible]
* Coloso	,,	Foreign	[illegible]	—	[illegible]
* Caupolican ..		,	30	—	80
* Several small boats of wood, totalling			35 and M Cy of [illegible]		

By J. Samuel White & Company, Ltd., East Cowes, Isle of Wight.

t Mohawk, ocean going Destroyer	Steel	British	800		15,000
t T.B. Nos. 13, 14, 15 and 16 First-class Torpedo Boats			32 ea	—	400 ea
* Nos. 1262 7 Pinnaces	Wood	Foreign	90	-	27[illegible]
* No. 1266, Screw in Tunnel Launch	Steel	British	14		10
* No. 1258, Towing Life Launch ..	Wood	,,	18	—	30
* No. 1261 Launch	Steel	Foreign	10	—	45
* No. 1268 Cutter	Wood	British	[illegible]	-	18
* No. 1269 ..		Foreign	15	—	22
* No. 1270 ..		.	1[illegible]		14

* Compound. † Triple. *m* Motor. *p* Petrol. *t* Turbine.

By Simpson, Strickland & Co., Ltd., Dartmouth, Devon.

Name of Vessel	Built of	Owners	G T Regis	G T inclu erect	I H P.
t Satanella ..	.. Steel	British	4	—	140
‡‡No. 666 ..	.. ..	Foreign	9	—	100
‡‡Al Khathra	.. Teak	..	14	—	45
a No. 669 ..	.. ,,	.	4	—	14
a No. 670 ..	.. ..	..	4	—	38
‡‡No. 671 2 ..	..Mahogany	..	11 (together)		90
‡‡No. 673 ..	.. ,,	..	7	—	45
‡‡No. 674 ..	.. Teak	British	5	—	23
‡‡No. 675 ..	.. Steel	Foreign	7	—	50
† Seagull ..	.. Teak	British	47	—	210
‡‡No. 677 ..	.. ..	..	3		17
* No. 678 ..	..Mahogany	Foreign	3	—	18
‡‡Nos. 679 680	.. Teak	British	14 (together)		60
No. 681 ..	.. ..	Foreign	9	not supplied	
† Kingfisher	..Mahogany	British	6	—	62
† No. 683 ..	.. Teak	Foreign	8		76
† Sirius ..	.. Steel	Foreign	18	-	55
‡‡ Constructor	.. Steel	..	13		80
‡‡Nos. 686 691	..Mahogany	..	29 (together)		210
‡‡Nos. 692-697		..	24		150
† No. 701 ..	.. Steel	British	8		62

By H. R. Stevens, Ltd., West Quay, Southampton.

m Mildred ..	.. Yawl	British	20		—
Scamp ..	.. Cutter	—	8		
McLoo ..	. Sloop		5		—
Aythine ..	.. Cutter		10		—

BRISTOL CHANNEL, &c.

By C. H. Walker & Co., Ltd., Sudbrook, Chepstow, Mon.

Name of Vessel	Built of	Owners	G.T Regis	G T inclu erect	I H P
† Hopper No. 2	Steel	British	434		400
Nos. 132 133, 134 135 and 136..	.	.	18ea		
H. B. Maxwelton		..	437		—
Nos 138 139, 140 141 142 & 143	..	..	30ea	-	—
Nos. 144 and 145	..	..	106ea	-	-
No 146 ..	,,	..	250		
Nos. 42 to 69 ..	Steel square section,		5,348		
Nos 7 to 18 ..	. ..	..	523		

THE MERSEY, &c.

By Cammell, Laird & Co., Ltd., Birkenhead.

Name of Vessel	Built of	Owners	G T Regis	G T inclu erect	I H P
H.M.S. Cossack	Steel	British	725	—	14,000
Oyapock		Foreign	1,294	—	1,800
Javary	.	..	1,294	—	1,800
Palinurus .. .	..	British	290	—	475
Brazil	..	Foreign	290		150
H.M.S. Swift .	..	British	1,680	—	30,000

By The Garston Graving Dock and Shipbuilding Co., Ltd., Garston, Liverpool.

* Princess Ena .	Steel Schooner	British	1,308	—	800
* [illegible]	Steel Ketch	.	240		400

By Nicholson & Sons, Glasson Docks, *via* Lancaster.

[illegible] .	Steel Schooner	British	[illegible]		[illegible]

By Isaac Pimblott & Sons, London Road, Northwich.

B[illegible]	Steel	Foreign	30		
[illegible]	—	—	[illegible]	—	—
[illegible]	—	—	[illegible]	—	
B[illegible]	Steel	British	[illegible]	—	
[illegible]	—	Foreign	[illegible]	—	—
[illegible] Launch	Wood		[illegible]	—	[illegible]
[illegible]	—	—	[illegible]		[illegible]

* Compound. † Triple. q Quadruple. m Motor.
‡‡ Compound Surface Condensing.

By T. Summers & Sons, Liverpool.

Name of Vessel	Built of	Owners.	G T Regis.	G T inclu erect.	I.H.P.
‡ 985 B	Wood Launch	British	15	15	20
‡ Atahualpa, Huayna & Bolmore	..	.	15ea	15ea	20ea

By Vickers, Sons & Maxim, Ltd., Naval Construction Works, Barrow-in-Furness.

s.s. Investigator	Survey Vessel, built for the Government of India.
T.S.S. Slieve Bloom	Cattle and Cargo Vessel, built for the London & North-Western Railway Co.
T.S.S. Slieve Gallion	do. do. do.
T.S. Tug Cartmel	Built for the Furness Railway Co.
Hopper Barge, No. 3	Built for the Furness Railway Co.

and other ships.
Total Tonnage 4,882
Total Indicated Horse Power 15 150

By R. Williamson & Son, Shipbuilding Yard, Workington.

† Volpone ..	Steel Steam	British	530	—	—
† Voreda . ..	..	..	558	—	—

By Wm. J. Yarwood, Castle Dockyard, Northwich, Cheshire.

Joyce ..	Steel	British	100	Towing Barge	
Nos. 90 and 94 ..	Compos.	Foreign	45ea		—
‡‡King George ..	Steel	..	180 pass.	—	130
‡‡Eileen .. .	.	British	120	80	160
‡ Orrell	..	..	120	—	120
‡‡Pennar	.	..	130	75	160
Foxglove and Cowslip	.. Compos. Barge	—	60ea		—
t Diana	Steel Launch	Foreign	—	—	28
Maroca	Steel Barge	..	30	—	—

THE RIBBLE.

By The Lytham Shipbuilding & Engineering Co., Lytham, Lancs.

Name of Vessel	Built of	Owners.	G.T Regis.	G T inclu. erect	I H P.
* Barnum (steam Barge)	Steel	—	—	40app	80app.
Towing Barge ..	..	—	—	40app.	—
* Steam Barge ..	..	—		35app.	80app.
† Brito (Amazon River steamer) ..		Foreign	285	—	560
† Sophia Martins		..	319	—	560
† José Martins	. .		135		400
* Republica	.. .	.	—	65app.	200
* Nethergarth (Tug)	..	British	96	—	346
Towing Barge ..	..			30app.	—
2 Towing Barges.		—	40ea	—	—
* Overgarth (Tug)	.	British	97		346
* Sternwheeler ..	.	—	..	30app.	40app.
* Steam Launch ..			—	75app.	100ap.

ISLE OF MAN.

By Joseph Qualtrough, Castletown, Isle of Man.

Name of Vessel	Built of	Owners	G T Regis	G T inclu erect	I H P
Reaper	Wood Schooner	British	127		

* Compound. † Triple. ‡ High Pressure. t Turbine.
‡‡ Compound Surface Condensing.

ROYAL DOCKYARDS.

By H.M. Dockyard, Portsmouth.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. incl. erect	I.H.P.
1st-Class Battleship Bellerophon	Steel	—	—	—	—

By H.M. Dockyard, Pembroke.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. incl. erect	I.H.P.
† Defence	Steel 1st Class Armoured Cruiser	—	14,600 dis.	—	27,000

By H.M. Dockyard, Devonport.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. incl. erect	I.H.P.
t 1st Class Battleship Temeraire	Steel Armoured, no sails	—	—	—	23,000 Full power

LIST OF VESSELS ENGINED IN 1907.

By Amos & Smith, Hull.

Name of Vessel	Builders	I.H.P.	Press. lbs.
† Sanson	Cook, Welton & Gemmell	420	—
† 8 Vessels		280ea	—
† Sheraton & Vera		550ea	—
† Saxon		600	—
† Ruby	Cochrane & Sons	470	—
† 3 Vessels		420ea	—
† Tokio		560	—
* Fraserburgh		230	—
† Indian Empire		[illegible]	—
† Dowsland and Gloria		450ea	—
† Triumph	Charlton & Doughty	450	—
† Camellia & Dentaria		500ea	—
† Onward Ho	Earle's Shipbuilding and Engineering Co.	670	—
† La Slack	Bonn & Mees	460	—
† 2 Sets	For Export	500ea	
† 1165		650	
† 4 Sets		520ea	
	Total	14,620	

By Baird Bros., North Shields.

Name of Vessel	Builders	I.H.P.	Press. lbs.
* Faithfull	James Weatherhead and Co.	[illegible]	[illegible]
* Uberous	Jos. T. Eltringham and Co.	[illegible]	[illegible]

By Central Marine Engine Works, West Hartlepool.

Name of Vessel	Builders	I.H.P.	
† Szterenyi Magyarorszag, Grof Serenyi Bela and Pollacsek	Fiume	[illegible]	
† Despina G. Michalinos	Piraeu	[illegible]	
† Frixos and Hartington	London	[illegible]	
† Welbury	West Hartlepool	[illegible]	
† Ivar	Copenhagen	[illegible]	
† Maylands	West Hartlepool	[illegible]	—
† No. 751		[illegible]	
† Selja	Bergen	[illegible]	
† Whitby Abbey	Hull	[illegible]	
	Total	[illegible]	

By George Clark, Ltd., Sunderland.

ss. Tweed, Norfolk, Su[illegible], Regin[illegible], [illegible], Annette Furness, Saint M[illegible], Mo[illegible], Principe di Piemonte, San Giorgio, Co[illegible], Bel[illegible], San Gio[illegible], Guiana, Ladywood, Saltmar[illegible], [illegible], K[illegible]ingham and Flora. Total [illegible] engines. Nominal horse power by Lloyd's Rules 772[illegible]. Estimated indicated horse power 48,500.

* Compound. † Triple. *t* Turbine.

By Blair & Co., Ltd., Stockton-on-Tees.

Name of Vessel	Builders	I.H.P.	Press. lbs.
s.s. C[illegible]pool & Margam Abbey	Ropner & Son, Stockton-on-Tees	[illegible]	
s.s. Washington	Richardson, Duck & Co., Stockton	[illegible]	
s.s. Crossh[illegible]	Robt. Stephenson & Co. Ltd., Hebburn	[illegible]	—
s.s. Transport	R. Craggs & Sons, Ltd., Middlesbro	1,700	—
s.s. Llongwe[illegible]	Richardson, Duck & Co., Stockton	1,9[illegible]	—
s.s. Oiz Mendi & Au Mendi	Ropner & Sons, Stockton-on-Tees	[illegible]	
s.s. Udal[illegible] Mendi	Euskalduna Co., Bilbao, Spain	[illegible]	
s.s. River Forth	R. Stephenson & Co. Ltd., Hebburn	[illegible]	—
s.s. Kossuth Ferencz and Morawitz	J. L. Thompson & Sons, Sunderland	[illegible]ea	
s.s. Zermatt		[illegible]	—
s.s. Acre	Craig, Taylor & Co., Stockton	[illegible]	—
s.s. Vittoria	Richardson, Duck & Co., Stockton	1,4[illegible]	
s.s. Ingleby	Ropner & Sons, Stockton-on-Tees	1,7[illegible]	
s.s. New York City	Richardson, Duck & Co., Stockton	[illegible]	—
s.s. Antinous	R. Thompson & Sons, Sunderland	[illegible]	—
s.s. Coleby	Ropner & Sons, Stockton-on-Tees	[illegible]	—
s.s. Sussex Coast	Wm. Harkess & Son, Middlesbrough	[illegible]	
s.s. Karanja	R. Thompson & Sons, Sunderland	[illegible]	—
s.s. Snowdonian	Richardson, Duck & Co., Stockton	[illegible]	—
s.s. Baltic Exchange	Bartram & Son, Sunderland	[illegible]	
s.s. Thor	Ropner & Sons, Stockton-on-Tees	[illegible]	
s.s. [illegible]	R. Craggs & Sons, Middlesbrough	[illegible]	
s.s. Harlseywood	Ropner & Sons, Stockton-on-Tees	[illegible]	
s.s. Cedarwood	Wm. Harkess & Son, Middlesbrough	[illegible]	
s.s. Bill[illegible]	Richardson, Duck & Co., Stockton	[illegible]	—
s.s. [illegible] twin screw	Craig, Taylor & Co., Stockton	[illegible]	
s.s. [illegible]	R. Stephenson & Co. Ltd., Hebburn	[illegible]	—
s.s. [illegible] twin screw	Craig, Taylor & Co., Stockton	[illegible]	—
	Total	49,[illegible]	

By Davis & Co., Lowestoft.

* [illegible]	H. Reynolds	[illegible]	[illegible]
* [illegible]	[illegible]	[illegible]	[illegible]
* [illegible]	[illegible]	[illegible]	[illegible]
		Total [illegible]	

* Compound.

By Crabtree & Co., South Town Ironworks, Gt. Yarmouth.

Name of Vessel	Builders.	I H.P.	Press lbs
* Princess Ena ..	Garston Graving Dock and Shipbuilding Co...	800	130
* Grosvenor ..	,, ,, ..	400	130
* Ernest & Ernestine	Van Damier Frere & Cie.	270ea	120ea
* Lancashire ..	Montrose Shipbuilding Co.	220	120
* 5 Boats Steel Steam Drifters	Cochrane & Sons	850	140
* 4 .. ,, Steam Drifters	Crabtree & Co., Ltd. ..	760	140
* 2 .. ,, Steam Drifters	Charlton & Doughty ..	420	140
* 7 ,, Wood Steam Drifters	Fellows & Co., Ltd. ..	1,225	130
* 4 .. ,, Steam Drifters	H. Reynolds & Son ..	680	140
* 4 ,, Steam Drifters	R. Kitto & Son	700	140
* 3 .. Steam Drifters	S. Richards & Co., Ltd.	490	140
* 2 .. ,, Steam Drifters	Sanders & Co.	380	140
* 1 .. ,, Steam Drifters	G. Houston	175	140
* 1 ,, Steam Drifters	G. Thompson	175	140
* 1 .. ,, Steam Drifters	G. Thompson	130	150
	Total	6,040	

By Elliot & Garrood, Ltd., Ingate Iron Works, Beccles.

† 8 Vessels	Jno. Chambers, Lowestoft	200ea	175ea
* 4 Vessels	,, ,,	170ea	140ea
† Shield	S. Richards & Co., Ltd., Lowestoft	200	175
* Primrose J.H.	Jno. Chambers, Lowestoft	100	130
* 2 Vessels	H. Reynolds, Oulton Broad	170ea	140ea
† Begonia, I.N.S.	W. Wood & Son, Lossiemouth, N.B.	200	175
* Pelikau (of Norway)	(Norwegian built) ..	30	160
† Grimsy (of Norway)	(Norwegian built) ..	35	160
* 6 Vessels	Jno. Chambers, Lowestoft	100ea	130ea
* Hope, L.T. ..	Beeching Bros., Ltd., Great Yarmouth ..	170	140
	Total	3,955	

By G. T. Grey, Holborn Engineering Works, South Shields.

**Guazu	Dundee Shipbuilding Co.	470	—
**Vesta	A. Vuijk & Sons, Holland	900	—
**Carl Lehnkering	,, ,,	1,200	—
**Herald	J. T. Eltringham & Co.	850	—
**Frithjof	Framnæs Mekanishe Værksted	350	
**Elstad	J. Meijer, Holland ..	700	—
**Thora	A. Vuijk & Sons, Holland	930	—
**Grace Darling ..	Van Vliet & Co., Holland	570	—
**Grib	Framnæs Mekaniske Værksted	350	—
**Carl	,, ,,	410	—
**Beluga	J. T. Eltringham & Co.	850	—
	Total	7,580	

By Hepple & Co., Ltd., South Shields.

* [illegible] ..	Hepple & Co., Ltd. ..	350	130
Acton Grange ..	J. T. Eltringham & Co. Ltd.	400	45
Flying Fish ..	Re classed	400	45
[illegible]	Hepple & Co. Ltd. ..	425	35
* [illegible]	,, ..	250	130
Old Trafford	J. T. Eltringham & Co., Ltd.	400	45
* Glencona	Hepple & Co., Ltd. ..	360	130
* [illegible] Trieste	,, ..	160	100
	Total	2,745	

* Compound. † Triple. ** Twin Compound.

By Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., Newcastle-on-Tyne.

Name of Vessel.	Builders	I H P	Press. lbs.
t H.M.S. Ghurka	Hawthorn Leslie ..	14,250	—
t H.M.S. Téméraire	Devonport Dockyard ..	23,000	—
t H.M. Torpedo Boat No. 21 ..	Hawthorn Leslie ..	4,000	—
† Tasmanic	,, ,, ...	2,750	—
	Total	44,000	

By C. D. Holmes & Co., Hull.

† 9 Vessels	Cook, Welton & Gemmell, Beverley	450ea	—
† Eros	,, ,,	500	—
† 2 Vessels	,, ,,	430ea	—
† Frazer	,, ,,	550	—
† Roman	,, ,,	700	—
† 9 Vessels	Cochrane & Sons, Selby	450ea	—
† 4	,, ,,	375ea	—
† 4	,, ,,	430ea	—
† Conquest	Dundee Shipbuilding Co.	450	—
† Roxano	Charlton & Doughty, Ltd.	450	—
	Total	14,830	

By T. & J. Hosking, Ltd., Bermondsey.

‡ ——	Foreign	300	120
f ——	,, ...	75	150
‡ ——	British	280	120
‡ ——	,, ...	90	150
‡ ——	,, ...	130	140
‡ ——	,, ...	200	120
‡ ——	,, ...	85	130
‡ ——	,, ...	260	120
	Total	1,420	

By MacColl & Pollock, Ltd., Wreath Quay Engineering Works, Sunderland.

Hibernia	Milford Haven	450	—
3 Vessels	Swansea	470ea	—
Lagos & Forcados	Liverpool	580ea	—
5 Vessels	Yarmouth	200ea	
Cottingham ..	Goole	450	—
Britannia ..	Milford Haven	450	—
Thimbleby and Grantley	West Hartlepool ..	1,080ea	—
Empress of Midland	Ontario	1,030	—
Saxon & Beatrice	Milford Haven	470ea	—
Grappler	Seaham Harbour	120	—
Gallinule and Dublin	Liverpool	470ea	—
Atlantic	Milford Haven	450	—
	Total	10,560	

By Mumford & Co., Colchester.

† s.s. Bosphorous No. 787 ..	Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., Newcastle-on-Tyne	450	160
† s.s. Bosphorous, No. 788 ..	,, ,, ..	450	160
* s.s. Regulus, 781	Swan, Hunter & Wigham Richardson, Ltd. Wallsend	820	120
‡ Water Tank Steamer Iguassu	Forrestt & Co., Ltd., Wyvenhoe	200	120
‡ Hospital Launch for Rio ..	ditto	120	130
‡ 4 Admiralty 56 ft. Pinnaces	Forrestt & Co., Ltd., Wyvenhoe; Hansen & Co., Cowes	800	185
‡ 8 Admiralty 45 ft. Pinnaces	Forrestt & Co. Ltd., Wyvenhoe; J. Read, jun., Portsmouth ..	1,000	185
‡ Steam Trawlers .	Various	960	140
‡ Various Launches	Various	1,000	120
	Total	5,800	

* Compound. † Triple. ‡ Compound Surface Condensing *f* Compound Non-Condensing. *t* Turbine.

The Royal Mail Express Turbine Steamer "Mauretania."

Built by Messrs. Swan, Hunter & Wigham Richardson, Limited, Wallsend-on-Tyne, for the Cunard Line.

By North-Eastern Marine Engineering Co., Ltd., Wallsend and Sunderland.

Name of Vessel	Port of Register	I.H.P.	Press lbs.
Annetta	Bristol	1,650	—
Anine	Copenhagen	9[illegible]	—
a Anglo-Colombian and Anglo Mexican	London	3,150ea	—
Akershus	Christiania	1,595	—
Antinoe	London	1,455	—
Ambriz	Lisbon	690	—
Benin	Liverpool	2,5[illegible]	—
B. F.	Valogne	550	—
Burnhope	Newcastle	1,300	—
Bendoran	Leith	2,270	—
Blackwood	North Shields	995	—
Baltic Sea	London	1,280	—
Blackwell	Sunderland	[illegible]	—
Buyo Maru (Oil Burning)	Japan	3,000	—
Canterbury	London	2,350	—
Carbineer	Newcastle	950	—
Crispin	Liverpool	3,000	—
Cronstadt	Leith	1,065	—
Cardigan	West Hartlepool	2,250	—
Daisy	Copenhagen	900	—
Derwenthall	West Hartlepool	1950	—
Duke of York	Whitby	1,730	—
Dunelm	Sunderland	1,380	—
Delia	Bremen	87[illegible]	—
Elfrida	Newcastle	1,700	—
Elterwater	Newcastle	995	—
Elisabeth	Terneuzen	1,[illegible]25	—
Ellen	Sandefjord	2,515	—
Fitzclarence and Fitzpatrick	Glasgow	2,400ea	—
Peliz	Sandefjord	1,550	—
Fram	Haugosund	1,050	—
Fleetwing	Newcastle	1,045	—
Holywell	Sunderland	3,150	—
Hebburn	Newcastle	1,300	—
Heimdal	Goteborg	865	—
Helena	Terneuzen	1,025	—
Hestia	Bremen	87[illegible]	—
Ibo	Lisbon	520	—
John Miles	London	705	—
Kabinga Karonga & Port Pirie	London	3,000ea	—
Kristiania	Christiania	1,035	—
Knottingley	Goole	780	—
Kronprins Olav	Sandefjord	2,515	—
Lady Lewis	Cardiff	2,540	—
Leif	Copenhagen	1,435	—
Lovland	Arendal	1,550	—
Musketeer	Newcastle	950	—
Nenenstein	Hamburg	1,750	—
Navarra	Christiania	1,000	—
Norfolk	Bergen	1,840	—
Orsovo & Turul	Fiume	2,000ea	—
Oehringen	Hamburg	1,920	—
Ocland	Christiania	1,775	—
Pennsylvania	Copenhagen	2,300	—
Ross	Cardiff	1,700	—
Royal Prince (Quadruple)	Newcastle	3,500	—
Redwood	North Shields	995	—
Slawentlitz	Hamburg	1,920	—
Sygna	Bremen	2,645	—
Sofie	London	400	—
Tees	Newcastle	1,047	—
Tord	Stockholm	1,005	—
Vikingen	Goteborg	1,435	—
Whitewood	North Shields	995	—
Wychwood	London	1,195	—
C. 1774		1,850	
	Total	[illegible]	

a Quadruple.

By The Parsons Marine Steam Turbine Co., Ltd., Turbinia Works, Wallsend-on-Tyne.

	Name of Vessel	Builders	I.H.P.	Press lbs.
t	H.M. Torpedo Boat Destroyer Afridi	Sir W. G. Armstrong Whitworth & Co. Ltd.	—	—
t	H.M. Yacht Alexandra	A. & J. Inglis Ltd.	—	—
t	Despatch Boat for Imperial Japanese Navy	Mitsu Bishi Dockyard and Engine Works Nagasaki	—	—
t	Tenyo Maru		—	—
t	Sister Vessel to the Tenyo Maru			—
t	Spare set for H.M. First class Torpedo Boats	—	—	—
		Total	65,500	

By Plenty & Sons, Ltd., Newbury.

	Name of Vessel	Builders	I.H.P.	Press lbs.
†	Corona	Unknown	300	—
	Fire Floats	G. Rennie & Co., London	600	
	Launch		300	—
	Hopper Barge	Walker & Co., Ltd., Sudbrook	420	—
	Maros	Austrian	600	—
	Hopper Barge	Walker & Co. Ltd., Sudbrook	420	—
*	Unknown	Java	20	—
	2	Portugal	300	—
	8	Spanish	700	—
	3	Rio	350	—
	2	Khartoum	230	
	Ferry Boat	Rennoldson & Son S. Shields	130	
	Unknown	Corral	70	
	Hilario	Tranmere Bay Co., Birkenhead	160	
	Albatroz	Brazilian Government (Forrestt)	350	—
	2 Drifters	Dunn & Co., Lossiemouth	260	
	Unknown	Indian	40	—
	Una	Pickett J., Southampton	200	—
	Vulture	Crown Agents for the Colonies	140	—
	Launch 2044	G. Rennie Co., for Calcutta	160	—
	Unknown	Colombo	25	—
		Austria	200	
		Total	6,035	

By Richardsons, Westgarth & Co., Ltd., Hartlepool, &c.

s.s.'s Echunga and Rotterdam	[illegible]200ea
s.s.'s Celebes Westerwald and Spreewald	2,800ea
s.s. Rapidan	2,[illegible]00
s.s.'s Irmingard Farley Netherlee, Queen Elizabeth Flodden and Graciana	2,000ea
s.s.'s Kathleen and Nora	1,750ea
s.s.'s Competitor Palma Mars Calcutta and Eleni Stathatos	1,700ea
s.s. Abonema	1,600
s.s.'s Richmond, Washington Newport News Arabiana and Lugano	1,500ea
s.s. Urilla	1,450
s.s. Marina	1,400
s.s. Yarra	1,350
s.s.'s Westwood, Cornwall and Pomaron	1,200ea
s.s.'s Dagenham and Whorlton	1,100ea
s.s. Westhampton	1,050
s.s.'s Thornley and Ryhope	950ea
s.s. Ludworth	850
s.s.'s Wyoming, Idaho and Arizona	550ea
s.s. Isbjorn	450
s.s. Ice Breaker	250
Total	66,250

* Compound. † Triple. *t* Turbine.

By The Shields Engineering & Dry Dock Co., Ltd., North Shields.

Name of Vessel	Builders	I H P	Press. lbs
† Ambroise Pare	Smith's Dock Co., Ltd.	630	—
† Fane	J. T. Eltringham & Co.	525	—
† Coronet	Smith's Dock Co., Ltd.,	540	—
† Cygnet	,, ,,	525	—
* Josephine	Stevenson & Asher ..	230	—
* Tropic Bird ..	Smith's Dock Co., Ltd.	230	—
† Swan	Goole Shipbuilding Co.	525	—
† Orphesia	,, ,,	540	—
* Guide Me ..	Stevenson & Asher ..	230	—
† 3 Vessels	Smith's Dock Co., Ltd.	475ea	—
† Louise & Adelaide	,, ,,	500ea	—
† Naamah	,, ,,	530	—
† Canadian	,, ,,	480	—
† Turenne	,, ,,	580	—
* Irene	Stevenson & Asher ..	220	—
† City of Edinburgh	Dundee Shipbuilding Co.	540	—
† Lawrenny Castle	Smith's Dock Co., Ltd.	520	—
	Total	9,270	

By W. Sisson & Co., Gloucester.

‡Kassed Kareem	Salter Bros., Oxford ..	75	165
/ Side Wheel Steamer ..	,, ,,	90	150
† Windermere Launch ..	N. Shepherd Bowness-on-Windermere ..	30	200
/ Ditto ditto	Borwick & Sons, Bowness-on-Windermere	30	150
† Launch for abroad	Simpson, Strickland & Co., Dartmouth ..	28	250
	Total	253	

By The Thames Engineering Works, Greenwich, S.E.

L. 26A.	The Thames Ironworks	400	—
‡L. 26B.	,, ,,	400	—

By The Vauxhall & West Hydraulic Engineering Co., Ltd., Luton.

‡ shipped abroad.	.. .. ..	130	120
‡ ,,	.. .. ..	175	120
‡ ,,	.. .. ..	120	180
‡ ——	Edwards & Co.	110	130
‡ 5 Vessels	Cochrane & Sons	206ea	140ea
† 3 Tugs sh. abr. ..	Edwards & Co.	900	165
‡Paddle Yacht ..	,, ...	150	120
‡S.T. Yeoman ..	H. Scarr	105	—
‡ ——	shipped abroad	160	120
‡Tunnel Launch	Edwards & Co.	20	120
‡ ——	,, ...	300	120
‡ ——	shipped abroad	180	120
	Total	3,470	

By The Wallsend Slipway & Engineering Co., Ltd., Wallsend-on-Tyne.

Ganelon	Messrs. Swan, Hunter and W.R., Ltd. ..	3,000	
Malta & Ceylon	,,	7,500ea	—
[illegible]	,,	6,700	—
[illegible] and Kas[illegible]	Sir W. G. Armstrong, Whitworth & Co. ..	8,000ea	—
H.M.S. [illegible] ..	,,	3,[illegible]	
Tarmo	,,	3,[illegible]	
Sebara	,,	3,[illegible]	—
Oberon	,,	2,750	
Derlent	,,	1,8[illegible]	
Australic	Messrs. Hawthorn, Leslie & Co.	2,600	—
Canadian	Messrs. William Dobson and Co	1,200	
	Total	70,100	

* Compound. † Triple. ‡ Compound Surface Condensing. / Compound Non Condensing.

By John S. Vaux & Co., Sunderland.

Name of Vessel	Builders.	I.H.P.	Press. lbs.
* 6 Vessels	Dundee Shipbuilding Co.	300ea	130ea
* Ph loth	John Duthie Sons and Co., Ltd.	300	140
* Excel	,, ,,	300	150
* Era	Forbes & Birnie	300	130
* No. 70	,, ,, ..	300	140
* Gowan	A. Noble & Co.	300	130
	Total	3,300	

By John Dickinson & Sons, Ltd., Palmers Hill Engine Works, Sunderland.

(A list of the vessels for which they have built engines and boilers), s.s.'s Eugenie S. Embiricos, Moorgate, Wintringham, Bratsberg, Ryde, Corfu, Manoravon, River Plate, Badagri, Kingsway, Portreath, President, Arnell, Eir, Carisbrook, Excellent, Alden, Zanoni. Total, 18 vessels. The total Lloyd's Nominal Horse Power is 5,495. In addition to the above, they have built 15 extra boilers.

SCOTCH.

THE CLYDE, &c.

By Ailsa Shipbuilding Co., Ltd., Troon and Ayr, Ayrshire.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I H P.
† Annan	Steel	British	1,133	—	1,850
* Aquilla	,,	,,	450	—	600
m Scout	,,	,,	110	—	260
† Maid of Honour	,,	,,	419	—	1,300
† Yulgilbar	,,	,,	779	—	1,350
† Moyle	,,	,,	1,325	—	1,330
* Blackwater ..	,,	,,	678	—	850
† Drake	,,	,,	2,400	—	1,700
† Chieftain	,,	,,	982	—	1,800
* Queen of the Lake	,,	,,	152	—	470
* Ophir	,,	,,	450	—	600
† Cariboo	,,	,, (probable)	900	—	1,200
10 Barges	..	—	1,000	—	—

By Alley & MacLellan, Ltd., Sentinel Works, Polmadie, Glasgow.

* No. 340	Steel S.S.	Foreign	—	87	150
No 341	Steel Barge	,,	—	33	—
Nos. 342 7 ..	,,	,,	—	258	—
Nos. 348-53 ..	,,	,,	—	702	—
Nos. 354 9 ..	,,	,,	—	402	—
* Britain	Steel S.W. Steamer	,,	—	500	550
* Gedid	,,	,,	—	300	400
No. 362	Steel Barge		—	71	—
No. 363-5			—	231	—
* No. 366	Steel S.W. Steamer		—	120	150

By Ardrossan Dry Dock and Shipbuilding Co., Ltd., Ardrossan.

† Camelo ..	Steel	Foreign		479	300
2 Towing Barges		—	—	105ea	—
3 Screw Tugs		—		55ea	160ea
Screw Ferry ..		British	—	19	40

By Barclay, Curle & Co., Ltd., Whiteinch, Glasgow.

Walton Hall ..	Single Screw	British	4,963	—	2,715
Peiho	,,	Foreign	5,412	—	3,834
City of Paris ..	,,	British	9,202	—	7,127
Corsican	Twin Screw	,,	11,037	—	9,512
Tomaso Di Savoia	,,	Foreign	8,014	—	8,672
Principe Di Udine	,,	,,	8,014	—	8,672

* Compound. † Triple. m Motor.

By William Beardmore & Co., Ltd., Naval Construction Works, Dalmuir.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
Guilpue ..	Twin-Screw	British	4,500	—	4,000
Huanchaco	Single-Screw		5,000	—	3,500
Junin			5,000	—	3,500

By Bow, McLachlan & Co., Ltd., Paisley.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
Venezuela..	Twin-Screw	Foreign	733		1,000
Cardenas ..	Single-Screw		147	—	430
Nyanza ..	Twin-Screw	British	812		400
H.M. Robust .	Paddle Steamer	.	401	—	1,250
Henry ..	Single-Screw	Foreign	210	—	150
Stein			82	—	300
Granadero ..	.	..	58	—	[illegible]
Carlos Sarsotti	,,	..	58	—	[illegible]
Puerto Sastre ..	Twin-Screw	..	60		140
Felelicia Guiller-Mina ..	Single-Screw	.	64	—	130
Alice	.		46	—	160
6 Lighters .	Sailing	.	546	—	—

Marine Electric Power and Auxiliary Engines, mostly shipped abroad .. .. [illegible]

By Geo. Brown & Co., Garvel Shipyard, Greenock.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
Zayda	—	British	604	—	300
No. 39	—	—	144	—	—
Maytlower ..	—	,,	98	—	230
Commonwealth	—	.	98	—	230
Roosevelt ..	—	,,	98	—	230
Clyde	—	,,	97	—	230
Maritana ..	—	,,	97	—	230
Karatta			527	—	780
No. 1 Lloyd Uraguays	—	Foreign	627		311
Evangeline ..	—	British	650	—	1,100
Presidente ..	—	Foreign	146	—	500

By John Brown & Co., Ltd., Clydebank Engineering and Shipbuilding Works, Clydebank.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
H.M.S. Inflexible ..	Quad.-Screw Turbine Cruiser	British	17,500	—	41,000
Duke of Albany	Twin-Screw Steamer	.	2,260	—	7,600
Kenuta .	Single-Screw Steamer	..	4,953	—	2,300
Lima	.	..	4,953	—	2,300
Barry ..	Paddle Steamer	,,	497	—	1,400
Copenhagen	Triple-Screw Turbine Steamer	.	2,600	—	7,000
St. Andrew ..	,,	,,	2,530	—	10,800

By Caird & Co., Ltd., Greenock.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
† Marama ..	Steel	British	6,437	—	[illegible]

By The Campbeltown Shipbuilding Co., Campbeltown.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
† Amsteldam ..	Steel screw Steamer	Foreign	1,[illegible]33	—	—
† Driva[illegible]		British	1,250	—	—

By W. Chalmers & Co., Rutherglen.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
2 Steam Ferries		Foreign	—	350	[illegible]ea
No. 152 . ..	Steel Barge			15	
Nos. 153 and 154 Two Barges	—		—	40	—
Freelance	Schooner yacht	British	—	120	—
‡‡Imperatriz .	Twin screw Steamer	Foreign	—	130	[illegible]
No. 149	Barge		—	42	—

† Triple. ‡‡ Compound Surface Condensing.

By The Clyde Shipbuilding & Engineering Co., Ltd., Port Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
Douglas .. .	—	British	951	—	1,700
Makumbo .	—		1,159	—	1,100
Ostsee		Foreign	997	—	900
Oada	—	..	2,789	—	1,000
Kooyong	—	British	2,200	—	1,000
Luna . ..	—	Foreign	2,789		1,600
Suruga	—	,	—	—	2,200
Engines and boilers only.					
Chieftain . ..	—	British	—	—	1,900
Engines and boilers only.					

By Charles Connell & Co., Ltd., Scotstoun Shipbuilding Yard, Scotstoun.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
Inveresk . ..	—	British	4,[illegible]		2,300
Den of Crombie .			4,048		3,100
Mutlah	—		3,498		[illegible]
Den of Ruthven	—		4,037		3,100
Bahadur			4,045		1,900
Begum	—		4,640	—	1,900
Bisley . ..			4,[illegible]	—	3,000
Glendevon ..			4,[illegible]8	—	2,000
Kintail . .	—		3,537	—	1,800

By D. M. Cumming, Blackhill Dock, Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
* Yacare .. .	—	Foreign	16	19	30
* Water Barge	—		58	—	45
‡ Passenger Launch			36		60
Barge	—	.	82	—	—

By William Denny & Bros., Leven Shipyard, Dumbarton.

Victoria	Turbine	South Eastern & Chatham Ry.
Empress		. .. .
Maori		Union S.S. Co. of New Zealand.
Hirafu Maru ..		Nippon Yetsudo Kwaisha.
Tamura Maru ..	.	.. ,,
First class Torpedo boat		British Government.
Tofua	P.S.S.	Union S.S. Co., of New Zealand.
Bhamo	S.S.	P. Henderson & Co.

Also sundry steamers and barges shipped abroad in pieces. Total, 34,418 tons gross.

By Robt. Duncan & Co., Ltd., Port Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
† Strathdee .	Steel	Foreign	4,400	—	2,050
† Duna.. .. .		British	1,572	—	1,400

By David J. Dunlop & Co., Port Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
Niger..		Foreign	1,000	—	1,000
Lokoja . ..	—		1,000		1,000

By The Fairfield Shipbuilding & Engineering Co., Ltd., Govan, Glasgow.

Name of Vessel	Built of	Owners	G.T.	I.H.P.
t H.M.S. Indomitable	Steel	British	Total 48,020	Total 112,000
t Heliopolis ..				
t Cairo		.		
Hazel				
Assiniboia ..				
Keewatin ..				
t H.M.S. Bellerophon (machinery only)				
Boilers for H.M. Dockyard at Portsmouth		British	—	—
S.S. Stanley, Repairs and new boilers		—	1,000ab —	2,000

By John Fullerton & Co., Paisley.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu. erect	I.H.P.
* Apipé . .	Steel	Foreign	—	567	350
* Falucho .			—	606	420
* Britannia			—	517	370
* La Plata			—	430	370
* Dick			—	16	90
Barge .			—	76	—
* Olive .		Newry	—	354	410
* Pine ..			—	355	410

* Compound. † Triple. ‡ High Pressure. *t* Turbine.

By Wm. Fife & Sons, Fairlie.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu erect.	I.H.P.
Zwerver ..	.. Cutter	Foreign	55	—	—
White Heather II.	..	British	179	—	—
No. 544 ..	.. Petrol Motor Boat	—	3	—	—
Lilian ..	.. Cutter	British	10	—	—
Osborne ..	.. ..	Foreign	4	—	—
Almoraima	.. ..	..	4	—	—
Sorais ..	.. ..	British	8	—	—
Ya Veremos	.. ..	Foreign	8	—	—
Clio ..	.. .. ..	British	16	—	—
* Crusader ..	.. ..	,,	10	—	—

Thames Measurement.

* Partly built and shipped to Canada.

By Fleming & Ferguson, Ltd., Paisley.

† 3 Hopper Steamers	Steel	British	1,400ea	—	1,200ea
† 2 Dredgers ..	,,	,,	600ea	—	800ea
† Recovery	,,	..	500	—	600
† Affonso Penna Dredger ..	..	,,	800	—	800
† Industry do. ..	..	,,	200	—	200
Nos. 1, 2, 3 and 4. Hopper Barges	,,	..	400	—	—
† Wm. Strong, Hopper Steamer	,,	..	800	—	700
3 Hopper Barges	..	..	300	—	—
† 2 Sets triple expansion Marine Engines, shipped to Canada ..	..	..	..	..	1,600

By Ferguson Bros., Newark Shipyard, Port Glasgow.

† No. 171 Dredger	Steel	British	600	—	800
† Lord Desborough	,,	..	3,000	—	4,500
* Canterbury ..	,,	..	300	—	1200
* Gallwey	,,	..	200	—	300
† Tug Steamer ..	,,	..	200	—	500
* Shipment work .	,,	Foreign	200	—	400

By Greenock and Grangemouth Dockyard Co., Greenock.

† Strathavon s.s...	Steel	British	—	4,403	2,050
† Strathallan s.s...	,,	,,		4,404	2,050
† Avestruz s.t. ..	,,	Foreign	—	189	511
† Aguila s.t	,,	,,	—	665	600
Crane Pontoon	,,	British	—	1,600	—
† Carleton s.s. ..	,,	,,	—	1,351	900
† Crawlington s.s.	,,	,,	—	1,825	1,100
† Guahyba t.s.s...	,,	Foreign	—	1,900	1,400

(See also under Forth.)

By William Hamilton & Co., Ltd., Port Glasgow.

Bankdale	—	British	3,851	—	2,000
Strathness ..	—	..	4,354		2,050
Charlton Hall ..	—	..	4,750	—	2,450
Strathdon	—	..	4,399	—	2,050
Strathgarry ..	—	..	4,399	—	2,050
Sui-Mow	—	Foreign	1,904	—	1,200
Strathleven ..	—	British	4,396	—	2,050
Strathlyon ..	—	..	4,400	—	2,050
Lombok	—	Foreign	5,026	—	2,400
Ternate	—	.	5,026	—	2,400

By James & John Hay, Ltd., Kirkintilloch, Glasgow.

* Celt	Steel Smack	British	[illegible]	—	—

By David & William Henderson & Co., Ltd., Partick, Glasgow.

Ardanmhor	Steel Screw	British	4,447	—	2,450
Voltaire ..	. .	..	8,406	—	4,100
Chikuzen Maru	.	Foreign	2,501	—	2,850
Chikugo Maru .	,,	.	2,501	—	2,850
California	Steel Twin-Screw	British	8,662	—	9,550
Jeanara	,,	,,	4,380	—	2,450
Tabaristan ..	,,	.	3,883	—	6,050
[illegible] Barges	Steel Sailing	.	1,1[illegible]	—	—

* Compound. † Triple.

By A. & J. Inglis, Ltd., Point House, Glasgow.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T inclu erect	I.H.P.
t H.M.Y. Alexandra..	Steel	—	1,825	—	4,500
† Lucia Carbo ..	Ferry Steamer	—	1,678	—	2,500
†* 3 sets Engines and Boilers for shipment abroad					1,000

By Lobnitz & Co., Ltd., Renfrew.

* Quintus ..	Twin-Screw Hopper Barge	Foreign	662	—	690
* Commandant Lamy	Sternwheel Steamer	,,	171	—	250
* David Campista...	Bucket Dredger	British	642	—	800
† Miguel Calmon...	Suction Hopper Dredger	..	1,242	—	1,650
	Pontoon Crane	..	248	—	—
* Gongola	Sternwheel Str.	Foreign	143	—	220
† Doctor Saboia,..	Steam Hopper Barge	British	949	—	1,100
* Leon,..	.. Screw Tug	Foreign	27	—	90
———	.. Gold Dredger	..	158	—	160
———	.. Gold Dredger	..	106	—	120
*	Engines & Boilers	,,	—	—	760
———	.. Rockcutter	British	195	—	150
———	.. 2 Lighters 126 each	Foreign	252	—	—
———	.. Rockcutting Machinery	,,	—	—	150
———	.. 10 Pontoons, 42 each	..	420	—	—
* Gouverneur Ballay,.	Sternwheel Steamer	..	260	—	350
———	.. Rockcutter	,,	182	—	150
———	.. Gold Dredger	,,	115	—	120

By The London & Glasgow Engineering and Iron Shipbuilding Co., Ltd., Govan, Glasgow.

† Plata	Steel	Foreign	5,580	—	5300

By R. McAllister & Sons, Dumbarton.

Maovia ..	.. Composite cutter yacht	British	47	—	—
† Elvira ..	.. Wood cutter yacht	..	12	—	—
White Heather	. Motor Launch	,,	9	—	—
Elinor ..	.. Wood Steam Launch	Rangoon	15	—	—
——— ..	.. Steel Steam Launch	Foreign	11	—	—

By Archd. McMillan & Son, Ltd., Dumbarton.

Kasama	Steel Steam	British	4,635	—	—
Suruga ..	.. .	..	4,370	—	—
Celtic King	.. ..	..	4,123	—	—
Glenmount	.. ..	,,	1,958	—	—
Regina ..	. .	..	1,957	—	—
Stormount	.. ..	..	1,956	—	—
Kenora ..	.. ..	..	1,956	—	—
Sarasvati ..	.. .	..	963	—	—

By Murdoch & Murray, Port Glasgow.

Rossmore ..	..Steel S.S.	British	627	—	650
India ..	.. Steel Sailing Barge	Foreign	767	—	—
Gerd	..Steel S.S.	..	2,090	—	1,450
Vidar	.. ..	.	2,074	—	1,450
Rio Machado ..	..	..	329	—	700
Envira	. T.S.S.	..	293	—	450
Tocantins .	.	.	670	—	950

* Compound. † Triple. *t* Turbine.

By Peter MacGregor & Sons, Kirkintilloch.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
‡‡Rayo	Steel	Foreign	35	—	150
† No. 28		—	55	—	200
‡‡No. 29 .. .			45	—	120
No. 30			104	—	Barge
‡‡Manati		Foreign	56	—	300
‡‡Darfeel		..	60	—	300
Rosario		.	22	—	120

By Napier & Miller, Ltd., Old Kilpatrick.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
Rendova ..	..Oil carrying Barge	British	1,433	—	—
† Hsin Tsieh	..Steel, steam		2,133	—	2,000
† Princess Dagmar	.	.	968	—	1,200
† Strathblane ..			4,358	—	2,250
† Strathendrick..	.	..	4,379	—	2,250
† Baron Herries ..	.	.	1,610	—	1,200
† Falls of Orchy..	..		4,904	—	3,100

By Ritchie, Graham & Milne, Whiteinch, Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
1 Steel Dahabeah		Foreign	120		—
1 Screw Steamer	—	..	95	—	160
1 Stern Wheel Steamer ..			120	—	220
10 Steel Barges		.	1,200		
1 Stern Wheel Steamer ..	—		90	—	100
1 Do. do.			80		80
1 Screw Tug ..	—		50	—	100
1 Steam Launch			10		40
1 Stern Wheel Steamer ..			120		140

By A. Rodger & Co., Port Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
Strathgyle ..	2-deck	British	4,385	—	2,000
Francesco Musner	Single-deck	Foreign	2,890	—	1,625
Cumbrian ..	Quarter-Deck	British	1,131		900
Kylerona ..	..Single	.	1,771		1,300
Lamington ..	..		3,530		2,000
Helmsdale ..	..		3,155		2,100
Craigforth ..		.	2,899		1,625
Gardenia.. ..	..	Foreign	2,899	—	1,625

By Russell & Co., Kingston Shipbuilding Yard, Port Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
Martha Washington shelter deck twin-screw passenger and emigrant steamer..		Foreign	8,500		
Alice	.	,	6,126		—
Laura	..	,	6,125		—
Argentina ..			5,198		—
Esperanza de Larrinaga ..	Spar deck Cargo Steamer	British	4,980	[illegible]	
Springburn ..	..		4,955		
Otterburn.. ..	.	,,	4,936		
Vellore		.	4,926		—
Hallamshire ..			4,420		—
Cape Finisterre		,	4,379		—
Inverkip			4,353		—
Hillfern		.	4,269		—
Hillglen			4,269		—
Edoardo Musil .		Foreign	4,265		—

A. Robertson, Sandbank, S.O., Argyllshire.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
* Sweetheart II. .	Wood	British	20	—	
Shimna .. .	Cutter		50	Thames Tons	
Heatherbell ..	..		27		—

By Scott & Sons, Bowling, Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
† Jupiter .. .	Steel	Foreign	261	—	480
* Ardchattan ..		British	284		300
* Nora and Ruth			226ea	—	300ea
* Tiree			92		120
* Maggie	.	..	284	—	400
† Le Scorff	.	Foreign	661	—	550
* Saint Mungo ..	.	British	402	—	625

* Compound. † Triple. ‡‡ Twin Compound.

By Scotts' Shipbuilding & Engineering Co., Ltd., Greenock.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
Dalmore	Steel screw Steamer	—	4,716	—	2,600
Daldorch	..	—	4,717	—	2,600
Falls of Nith ..	..	—	4,712	—	2,600
Garza Mora ..	Sailing Lighter	-	472	-	-
Garza Blanca ..	.	—	472	—	—
Gallareta	.		472	—	—
Gaviota	.	—	472	—	—
Gallineta	.		472	—	—
Pladda	Steel screw Steamer		2,333		1,600
Manco	.		3,075ap	—	2,300
Odd Boilers ..		—	—	—	5,350

By J. Shearer & Sons, Ltd., Kelvinbaugh, Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
* Victor .	Fore and aft Schooner	British	435	450	650
* Leforth ...		.	227	245	275

By Wm. Simons & Co., Ltd., Renfrew.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
Bucket Dredger .	—	Foreign	400	-	650
Sand Pump Hopper Dredger .	—	British	1,400	—	2,380
Sand Pump Dredger ..	—		50	—	175
Bucket Dredger	-	Foreign	400	—	550
Tin Mining Dredger	—		300	—	300
2 Hopper Barges	—		800ea	—	680ea
Bucket Dredger	—	British	800	—	750
Pontoon	—	Foreign	20	—	—
Hopper Dredger	—		300	—	500
Hopper Barge .	—	British	800	—	680
Lighter	-	Foreign	130	—	—
Lighter	—	.	130	—	—

By Alexander Stephen & Sons, Ltd., Linthouse, Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
† Cooma	Steel	British	3,830	3,839	
† Ormiston ..		.	4,842	5,502	
† Kazembe ..			4,657	5,457	
† Grampian			9,597	11,197	35,93[illegible]
† Oceania .. .		Foreign	5,368	5,368	
† Wyreema .		British	6,100	6,100	
† Hesperian.. ..		.	9,598	11,108	

Built at repair works, Govan, and shipped abroad.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
Lucie..	Steel	British	55	—	—
Mary	..		35	—	—

By Mackie & Thomson, Ltd., Govan, Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
† 2 Trawlers	Steel	British	307ea	—	550ea
† St. Lawrence .			321	-	580
† 3 Fleeters			189ea	—	350ea
† Automne ..		Foreign	238		530
† Trawler .. .			213		400
* 11 Drifters		British	95ea		280ea
* St. Mungo .			95	-	295
* 6 Drifters ..			95ea	—	234ea

By John Reid & Co., Ltd., Whiteinch, Glasgow.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
m Spanker (Twin-Screw Yacht)	Steel	British	100	-	—

THE FORTH, &c.

By John Cran & Co., Albert Engine Works, Leith, N.B.

Name of Vessel	Built of	Owners	G.T. Regis	G.T. inclu erect	I.H.P.
† Betty, Steam Tug	Steel	British	120	-	550
* Antonio Ferro, Steam Tug ..		Foreign	82		300
† Bass Rock Trawler.. .		British	182		450
* Alexandra Steam Tug	.	.	168		780
2 Floating Cargo Hoists ..			40ihs. 30ihs.	—	

* Compound. † Triple. *m* Motor.

By Dee Shipbuilding Co., Ltd., Queen's Ferry, Near Chester.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T inclu. erect	I H P
Screw Tug ..	Steel	Foreign	55	—	90
6 Lighters ..	..	British	330ea	—	—
Screw Tug ..	Wood	Foreign	20	—	40
Motor Tug ..	..	British	10	—	30
Twin-Screw Tug	Steel	Foreign	70	—	100
Tunnel Launch	..	..	45	—	75
4 Motor Canoes	..	..	10ea	—	20ea
Screw Tug ..	Wood	.	50	—	90
Sternwheeler ..	Steel	..	10	—	25
Twin-Screw Steamer ..	..		100	—	130
Sailing Yacht ..	Wood	.	5	—	—
Sternwheeler ..	Steel	.	10		25
Screw Steamer	..	..	70	—	80
2 Towing Launches	..	.	25ea	—	35ea
Water Barge ..		.	250	—	120
Screw Tug ..		.	50	—	90
Screw Tug ..	..	..	80	—	100

By Greenock & Grangemouth Dockyard Co., Grangemouth.

† Aguila ..	Steel	Foreign	—	571	700
† Antonio Lauasa	..	..	—	1,261	1,250
† Cabot	..	British	—	465	440
† Pomaron	.	..	—	1,809	1,181
† Norton	..	..		1,810	1,181

(See also under Clyde.)

By Hawthorns & Co., Ltd., Leith.

Cavalier and Chimaera ..		British	–	–	350ea

By MacKay Bros., Alloa.

Allan .. .	S.S.	Foreign	1,285	—	—
Miranda	T.S.S.	..	1,108		
Caceres	..	..	1,108		
Murtinho	..	..	1,106		

By Ramage & Ferguson, Ltd., Leith.

† Hunter, Twin-Screw Steamer	Steel	British	1,840	—	2,200
† Wakiva, Twin-Screw Steam Yacht	..	Foreign	853	—	2,000
† Terawhiti Steam Tug	..	British	260	–	850
† Lady Blanche, Steam Yacht	.	.	360		650
† Tuna, Screw Steamer ..	..	..	662		900
† Liberty Twin Screw Steam Yacht	.	Foreign	1,570	—	2,000

By Scott of Kinghorn, Ltd., Kinghorn, R.S.O., Fifeshire.

† Fronsac Cargo ..	Steel	Foreign	516	516	500
† Kempsey, Pass.	..	British	484	484	900
† Manuel, Cargo ..	..	Foreign	979	979	1,000
† Crura, Passenger	..	British	1,300	1,300	2,600

Besides other Miscellaneous work, Boilers, Steering Gears etc.

The above Engines and Boilers were built and fitted on board by ourselves and launched complete with steam up ready for sea.

By J. Weatherhead, Eyemouth.

* Faithful . ..	Fore & Aft	British	87	—	—
* Excel III	..	..	86	—	—
Provider and Celia Wilson	Tug Boat	.	32ea	—	—
Ellen Fairbairn		..	10	—	

* Compound. † Triple.

THE TAY, &c.

By The Caledon Shipbuilding & Engineering Co., Ltd., Dundee.

Name of Vessel.	Built of	Owners.	G T Regis.	GT inclu erect.	I H.P.
† Hull and York	Steel Steam	British	1,132ea	—	2,300ea
* 4 Drifters ..	,,	..	98ea	—	250ea
† Kinta	,,	,,	1,220	—	1,800
† G. R. Crowe —	,,	British	2,270	—	1,000
* 2 Drifters ..	,,	—	98ea	—	250ea
† Lady Blake ..	,,	British	1,600	—	1,000

By The Dundee Shipbuilding Co., Ltd., Dundee.

† Conquest	Steel	British	243	–	400
† Tuazu	,,	Foreign	363		400
* 10 Vessels ..	..	British	94ea	—	230ea
* Cormorant ..	..	,,	94	—	230
* Magdalen ..	,,	,,	94	—	230
* Onward	..	,,	94	—	230
† Mary Stanby ..	..	,,	226	—	400
† City of Edinburgh	..	..	278	—	450
† Triton	,,	..	229	—	400
† Urania & Hero	,,	..	226ea	—	380ea
3 Barges	,,	Foreign	300	—	—

By Gourlay Bros. & Co. (Dundee), Ltd., Dundee.

Ulimaroa	Steel	British	5,700	—	7,000
Atalanta	,,	,,	576	–	1,600

THE DEE.

By Alexander Hall & Co., Ltd., Aberdeen.

Name of Vessel	Built of	Owners	G T Regis	G.T inclu. erect.	I.H P.
Horace Stroud ..	Trawler	British	202	—	350
Loch Loyal ..	,,	,,	197	—	350
Loch Broom ..	..	,,	197	—	350
Holly	Drifter	,,	90	—	180
Rose	Trawler	,,	225	—	350
Glenesk	..	,,	225	—	350
Glenprosen ..	,,	,,	225	—	350
Alert	Drifter	,,	96	—	200
Lebanon ..	,,	,,	111	–	260
Fort Edward ..	Trawler	,,	202	—	360
No. 437	Drifter	,,	90	—	180

By Hall, Russell & Co., Ltd., Aberdeen.

5 Drifters ..	-	British	100ea	—	280ea
Gloria ..	S. Trawler	..	107	—	420
Uno and Dos ..	S. Trawlers	Foreign	105ea		420ea
Oceanic and Pitullie	S. Drifters,	British	100ea	—	280ea
Enterprise and Industry ..	..	British	100ea		300ea
Dreadnought ..	S. Liner	..	150		350
Chrysoprasus ..	..	..	110		320
Swift ..	S. Drifter	..	102	—	300
Kimberley ..	,,	,,	102	–	280
2 Trawlers ..	—	,,	223ea		450ea
Loch Doon ..	S. Trawler	,,	198		420
Loch Kildonan	,,	,,	211		420
Ar Nen	,,	Foreign	168	–	400
North Star ..	,,	British	188		440
Peggy Nutten ..	,,	,,	193	–	400
2 Trawlers ..	,,	,,	223ea		450ea
Scot	,,	,,	202		450
2 Trawlers ..	,,	,,	202ea	—	400ea

* Compound. † Triple.

LIST OF VESSELS ENGINED IN 1907.

By J. Abernethy & Co., Aberdeen.

Name of Vessel	Builders	I H P	Press lbs
† Cairngorm ..	J. Duthie Torry S.B. Co.	550	180
* 9 Vessels	..	220ea	150ea
* Lapwing	Geo. Innes & Sons Portnochie	220	150
† Star of Freedom	J. Duthie Torry Shipbuilding Co.	420	180
† Islande	. .	550	180
	Total	3,720	

By Aitchison, Blair & Co., Clydebank.

‡ Maggie	Scott & Sons, Bowling	140	130
† Miranda Caceres and Murtinho	Mackay Brothers Alloa	1,060ea	180ea
‡ ———	Foreign	120	120
‡ —	.. ..	150	100
‡ S.S.	.. ..	180	120
‡ S.S.	. .. .	70	120
‡ T.S.	. .. .	240	30
	Total	4,380	

By Allan Anderson & Co., Eastwood Engine Works, Pollokshaws, Glasgow.

* 4 Vessels .	Messrs. Mackie & Thomson	280ea	130ea
* St. Mungo	.. ..	295	140
	Total	1,415	

By Campbell & Calderwood, Soho Engine Works, Paisley.

‡ Antonina	Ritchie, Graham and Milne Whiteinch ..	160	
20 Sets	Shipped abroad	1,450	
3	.. ..	650	
5	.. .. ..	1,360	
	Total	3,620	

By Clyne, Mitchell & Co., Aberdeen.

† Mariner	Alex. Slater, Lossiemouth	200	180
* Kinnaird	Alex. Noble, Fraserburgh	190	140
* Union	Wm. McIntosh & Son, Buckie	195	140
* Belona	Alex. Slater, Lossiemouth	195	140
* Bloom	Wm. McIntosh & Son, Buckie	240	140
† Ben Bheula and Ben Rossal ..	The John Duthie Torry Shipbuilding Co., Torry	410ea	180ea
* Utopia	Alex. Slater, Lossiemouth	195	140
	Total	2,035	

By Colin Houston & Co., Ltd., Kinning Park, Glasgow.

* S. T. Rayo ..	P. McGregor & Sons, Kirkintilloch	150	[illegible]
* S.S. Seapark ..	J. Shearer & Sons Scotstoun	[illegible]	130
* 2 Vessels	J. Fullerton & Co. Paisley	375ea	130ea
* S.T. Manati ..	P. McGregor & Sons, Kirkintilloch	300	130
* 6 Vessels	Mackie & Thomson, Govan	235ea	130
	Total	2,890	

By Cooper & Greig, Dundee.

† 1 Set of Engines	..	1,200	
1	. .. ..	1,300	
18 .	. tot. I.H.P. ..	3,600	
	Total	6,100	

* Compound. † Triple.
†† Twin Compound. ‡‡ Compound Surface Condensing.

By J. Cran & Co., Leith.

Name of Vessel	Builders	I H P	Press. lbs.
† Betty Steam Tug	John Cran & Co. .	550	180
* Antonio Ferro	.. ..	360	140
† Bass Rock Trawler	.. ..	451	180
* Alexandra Tug	.. ..	780	120
* 5 sets Engines & Boilers for Fishing Drifters .	Jas. Miller .. .	1,000	140
* 2 Sets do	.. Wm. Fulton	400	140
* 2 Sets do. do.	Wm. Weatherhead and Sons	400	140
	Total	3,947	

By Messrs. Denny & Co., Dumbarton.

† Culna	Eastern ..	—	—
t Victoria ..	. Channel ..	—	—
t Empress .	.. Channel ..	—	—
t Maori ..	. Colonial	—	—
t Hirafu Maru ..	Japanese Government	—	—
t Tamura Maru ..	Japanese Government	—	—
t No. 17 Destroyer	British Admiralty ..	—	—

Also a number of stern and side paddle-wheel steamers and twin-screws for steamers built abroad.
Total indicated Horse power 63,200.

By Dunsmuir & Jackson, Ltd., Govan, Glasgow.

† Kasama .. .	Arch. McMillan & Son, Ltd.	[illegible]500	—
† Annan .	Ailsa Shipbuilding Co. Ltd.	[illegible]900	
† Hsin Tsieh .	Napier & Miller Ltd. ..	2,600	—
† Princess Dagmar	. ..	[illegible]200	—
† Inveresk	Chas. Connell & Co. Ltd.	2,250	—
† Celtic King ..	Arch. McMillan & Son, Ltd.	2,400	—
† Bahadur and Begum	Chas. Connell & Co. Ltd.	2,000ea	—
† Argentina ..	Russell & Co.	4,000	Twin Screw
† Cramlington ..	Greenock & Grangemouth Dockyard Co. Ltd.	1,200	—
† Glendevon ..	Chas. Connell & Co. Ltd.	[illegible]250	—
† Kintail	.. .	1,950	
	Total	20,[illegible]50	

By Fishers Ltd., Paisley.

‡ For Shipment abroad	..	[illegible]	[illegible]
‡ Ardchattan ..	Scott & Sons, Bowling	[illegible]	[illegible]
‡ For Shipment abroad	T. B. Seath & Co. Glasgow	130	[illegible]
‡ Tiree	Scott & Sons, Bowling	140	[illegible]
‡ For Shipment abroad	T. B. Seath & Co. Glasgow	[illegible]	[illegible]
‡ " "	.	130	140
‡ " "	.. .	[illegible]	140
‡	P. McGregor & Sons Kirkintilloch . .	[illegible]	[illegible]
	Total	1,350	

By Gourlay Bros. (Dundee), Ltd., Dundee.

† 2 Sets .	Melbourne . .	[illegible]	—
† 2 . .	Southampton .	[illegible]	—
† 1 .	.. . .	500	—
† 1 .	Southampton .	[illegible]	—
† 1 .	.. .	[illegible]	—
	Total	[illegible]	

* Compound. † Triple. ‡‡ Compound Surface Condensing.
t Turbine.

By Gauldie, Gillespie & Co., Kinning Park, Glasgow.

Name of Vessel	Builders.	I.H.P.	Press lbs.
‡‡15 Sets	Total	2,700	—

By Hutson & Sons, Ltd., Kelvinhaugh Engine Works, Glasgow.

† Amsteldam ..	Campbeltown Shipbuilding Co.	800	—
† Duna	R. Duncan & Co., Ltd.	1 500	—
* Victor	J. Shearer & Sons, Ltd.	650	—
† Allan	McKay Bros.	950	—
† Aguila	Greenock & Grangemouth Dockyard Co., Ltd.	700	—
* Launch	Ritchie, Graham and Milne	50	—
	Total	4,650	

By John G. Kincaid & Co., Ltd., Clyde Foundry, Greenock.

† Laura & Alice .	Russell & Co., Port Glasgow	4350ea	—
† Hillfern & Hillglen	..	2,350ea	—
† Strathavon and Strathallan ..	Greenock & Grangemouth Dockyard Co., Greenock	2 250ea	—
† Itonus, twin-screw cargo steamer (one new engine supplied complete and other engine rebuilt (greater part being renewed) ..	Greenock & Grangemouth Dockyard Co. (Repairers)	385	—
† Tocantins ..	Murdoch & Murray, Port Glasgow	1 000	
	Total	22 75	

By W. V. V. Lidgerwood, Coatbridge.

† Jupiter	Scott & Sons Bowling ..	400	180
† Golden City .	Mackie & Thomson, Govan	550	200
† 3 Vessels	.. ..	350ea	200ea
† St. Lawrence ..	.. ..	580	200
Comte H. v. D. Burch	.. ..	400	180
* 7 Vessels	.. ..	280ea	130ea
† Euripides ..	..	550	200
† 2 Vessels	Smith's Dock Co. Ltd. Shields	420ea	180ea
† 3 Vessels ..	. ..	400ea	180ea
* Onward ..	Dundee Shipbuilding Co. Ltd., Dundee	280	130
† 4 Vessels	.. . ..	420ea	180ea
† Vinca	Goole Shipbuilding and Repairing Co., Ltd. ..	470	180
† Argon .. .	.. ..	420	180
† 3 Vessels	,, ..	440ea	180ea
† 4 Vessels	J. Duthie Torry Shipping Co.	400ea	180ea
* Support	. .. ..	240	150
† 4 Vessels . .	..	420ea	180ea
	Total	16540	

By Menzies & Co., Ltd., Leith.

* Carmela ..	The Ardrossan DryDock and Shipbuilding Co. Ltd.	300	150
* Verdant Seafield and Herald ..	W. & G. Gardner, Cullen	150ea	120ea
* Anchor of Hope	J. & G. Forbes, Sandhaven	200	145
* Launch	.	45	140
	Total	995	

* Compound. † Triple.

By Muir & Houston, Ltd., Kinning Park, Glasgow.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Hercules	Scott & Sons, Bowling	800	—
† Automne	Mackie & Thomson, Govan	550	—
* Portlairge ..	Dublin Dockyard Co., Dublin	350	—
† Glenmount ..	Archd. McMillan & Son, Ltd., Dumbarton ..	1,200	—
† Kenora	. .. ..	960	—
† Regina	. .. ..	960	—
† Stormount ..	. .. ..	1200	—
† Sui Mow	William Hamilton and Co., Ltd. Port Glasgow	1,400	—
* Samphire	Dublin Dock Co., Dublin	150	—
† Karatta	G. Brown & Co., Greenock	800	—
† Evangeline ..	.. ..	1,150	—
† Carleton	Greenock and Grangemouth Dockyard Co. Greenock	950	
	Total	10,470	

By Rankin & Blackmore, Eagle Foundry, Greenock.

† s.s. Sarasvati .	Archd. McMillan & Son, Ltd.	1,150	180
† Edoardo Musil ..	Russell & Co.	2,500	.
† Vellore	,, ,, ...	2,800	,,
† 4 Vessels	,, ...	2,700ea	.. ea
† 2 Vessels	.. ,, ...	2,500ea	. ea
† Martha Washington	. .. .	7,000	..
	Total	29,250	

By Renfrew Bros. & Co., Irvine.

† Le Scott	Scott & Sons, Bowling	600	180
† Voreda	R. Williamson & Son, Workington	550	160
* Olive	John Fullerton & Co., Paisley	450	130
* Pine	.. ,,	450	130
† Cabot	Greenock & Grangemouth Co., Ltd., Grangemouth	550	180
	Total	2,600	

By A. Rodger & Co., Govan.

† Strathgyle ..	A. Rodger & Co., Port Glasgow	2,600	—
† Francesco Mussner	. ..	1,625	—
† Cumbrian ..	. .	900	—
† Kylerona	. ..	1,300	—
† Lamington ..	. ,,	2,000	—
† Helmsdale ..	..	2,100	—
† Craigforth	. ,,	1,625	—
† Gardenia	.. ..	1,625	—
	Total	13,775	

By Ross & Duncan, Whitefield Works, Govan.

‡‡1 Set for	s.s. Rossmore	750	—
† 2	s.s. Bechtau and s.s. Dichtau .	1,700	—
† 1	s.s. Volpone	550	—
‡‡1	s.s. Aquilla	610	—
‡‡2	s.s.'s Nora and Ruth	560	—
‡‡2	s.s.'s Maritana and Clyde ..	460	—
† 1	s.s. Rio Machado	715	—
‡‡1	s.s. Tug Gladys	100	—
‡‡1	s.s. Enrira	460	—
‡‡1	s.s. Saint Mungo	600	—
‡‡1	s.s. Ophir	600	—
‡‡1	s.s. Tug Killaloe	130	—
24 Sets of Marine Screw Engines shipped abroad	.. ..	3,500	—
	Total	10,735	

* Compound. † Triple. ‡ High Pressure.

By David Rowan & Co., Glasgow.

Name of Vessel	Builders	I.H P	Press. lbs
† Junee	Mackie & Thomson	1 630	180
† Navarino ..	Wm. Hamilton & Co., Ltd.	2,600	200
† Banlodale	..	2,900	180
† 2 Vessels ..	Chas. Connell & Co., Ltd.	3,000ea	180ea
† 5 Vessels ..	Wm. Hamilton & Co., Ltd.	2,250ea	180ea
† Strathdon	Robt. Duncan & Co. Ltd.	2,250	180
† Mutlah ..	Chas. Connell & Co., Ltd.	2 500	200
† Aguila ..	Greenock & Grangemouth Dockyard Co.	670	180
† 2 Vessels ..	Napier & Miller Ltd.	2 250ea	180ea
† Avostruz ..	Greenock & Grangemouth Dockyard Co.	520	180
† 2 Vessels ..	Wm. Hamilton & Co., Ltd	2 800ea	180ea
† 2 Vessels ..	Murdoch & Miller. Ltd.	1,400ea	180ea
† Baron Herries	Napier & Miller, Ltd.	1,200	180
† Bisley	Chas. Connell & Co., Ltd.	3,300	200
† Falls of Orchy ..	Napier & Miller Ltd.	3 100	180
	Total	50,220	

By Trawlers & Traders Engineers Co., Ltd., Aberdeen.

* Grateful, Steam Drifter	Messrs. John Duthie Sons & Co., Ltd.	250	40

By White & Hemphill, Ltd., Roxburgh Engine Works, Greenock.

‡‡Zayda	Geo. Brown & Co.	340	—
‡‡Mayflower ..	.. ..	200	—
‡‡Imperatrix ..	Wm. Chalmers & Co.	180	—
‡‡Various Marine Engines ..	Foreign	220	—
High-Speed Land Engines and Centrifugal Pumps		150	—
	Total	1,090	

IRISH.

By The Dublin Dockyard Co., North Wall, Dublin.

Name of Vessel.	Built of	Owners.	G T Regis.	G T. inclu erect.	I H P
* Portlairge	Steel Grab Dredger	British	400	-	350
* Samphire ..	..	..	159	—	200
* Killaloe ..	Steel Tug	..	45	-	90
* Carlingford	Steel Ketch	..	—	358	575

By Harland & Wolff, Ltd., Belfast.

Name of Vessel.	Built of	Owners.	G T Regis.	G T. inclu erect.	I H P
† Fulani, ..	Steel, Single-Screw	British	3,730	—	3 100
† Prahsu	..	..	3,750	—	3,100
a Avon	Steel, Twin Screw	..	11 073	—	7,500
a Asturias ..		..	12,000	—	7,500
a Iroquois ..	..	..	9,202	—	4,000
Navahoe ..	Steel Ocean going Barge	—	7,850	—	—
a Pericles ..	Steel Twin-Screw		11,000	—	[illegible]
a Median ..	Steel Single-Screw	..	6,380	—	[illegible]
Suevic ..	Steel New Fore End, Twin Screw	..	5,500	—	—

By The Larne Shipbuilding Co., Larne.

* No. 32 ..	Steel	—	120	—	140
Lily (Barge) ..		British	180	—	—

* Compound. † Triple. ‡‡ Compound Surface Condensing. *a* Quadruple

By Workman, Clark & Co., Belfast.

Name of Vessel	Builders		I H P	Press lbs
† Chyebassa	Steel, Steam British	6 248	6,248	4,500
† Ceara	Foreign	3 323	3 323	3 400
† Para		3 351	3 351	3,400
† S. Paula ..		3,700	3 700	3 400
† Rio de Janeiro		3 700	3,700	3,400
† Whakarua	British	6,507	7,818	4,000
† Nerehana ..	..	6,532	7 753	4,000
† Kia Ora ..	..	6,557	7,804	4,500
† Verdi ..	..	6,577	7,120	4,100
† Coppename	Foreign	3,050	3,750	2 750
† Mantiqueira	..	1,650	1 700	1 200
† Ancona ..	..	8,800	9,200	7,000
12 Barges ..	—	2,560	2 560	—

LIST OF VESSELS ENGINED IN 1907.

By MacColl & Co., Ltd., Abercorn Basin, Belfast.

Name of Vessel.	Builders.	I H P	Press. lbs.
† T.S.S. Cariboo	Ailsa Shipbuilding Co.	1,000	—

FRENCH.

By Baheux Bros., Boulogne-sur-Mer.

Name of Vessel	Built of	Class	Owners.	G T Regis	I H P
† L'Europe ..	—	Trawler	Boulogne	325	520
m St. Gerard	—	Drifter	..	38	18

By The French Engineering and Shipbuilding Co., Dunkirk.

† Baleine & Nordcaper	—	Steam	Arcachon	418 ea.	700 ea.
† Tunisie		..	Dunkirk	3246	1500
† Île de la Réunion		..	Havre	4840	1500
† Saint André ..	—	..	..	2200	1100
† Provence ..	—	Trawler	Boulogne	384	650
† Marie Rose ..	—	..	..	200	500
† Madeleine ..	—	..	..	200	520
† 2 Trawlers ..	—	..	..	300ea	520ea
† Jean Bart ..	—	..	..	318	520
† St. André ..	—	..	..	286	500

By A. Normand et Cie., Havre.

† Claymore ..	–	Destroyer	French	320	7200
† Aizutte (Cie Suez)	—	Steam	—	60	1600
† Branlebas & Fantare	—	Destroyers	French	340ea	7200ea

By De La Brosse & Fouche, Nantes.

* Abeille.. IV. & V	Steel	—	Nantes	70ea	150ea
† 3 Vessels ..	..	—		302ea	450ea
* Refouleur [1] ..	..	—	—	—	1200
* Victor ..	..	—	Nantes	34	100
† André et Louis ..		—	.	302	500
† Germaine F. ..	..	—		230	450
* François I. ..		—	.	22	100

By La Cie. des Messageries Maritimes, La Ciotat.

† Sontay ..	Steel	Two-Screws	Marseilles	7 000	3,300

By Schneider & Co., Creusot.

† Yar Hissar	Steel	Destroyers	Turkey	305	6,300
† Cachoz ..	.	.	..	305	6,300

By The Mediterranean Shipbuilding Works, La Seyne.

Derrick .	Steel	—	Constantinople	181	-
† Mont Telvoux		—	Marseilles	4,818	[illegible]
* Mungo Park		—	Dakar	157	225
† Tonie		—	Marseilles	4,780	3,200
* Pilotine ..	Wood	—	.	6	15

LIST OF VESSELS ENGINED IN 1907.

By Caillard et Cie, Le Havre.

Name of Vessel	Builders	I H P	Press. lbs
† Île de la Réunion	Société des Chantiers de France, Dunkerque	[illegible]	90

* Compound. † Triple. *m* Motor.

BELGIAN.

By Chantiers Navals Anversois, Hoboken-by-Antwerp.

Name of Vessel.	Built of	Class.	Owners.	G.T Regis	I.H P
† Neuenstein	Steel	2-Masted	Hamburg	2564	1520
† Oehringen	,,	Fore & Aft Schooner	,,	3379	1710
† Slawentzitz	,,	,,	,,	3379	1710

By Charles Delsaux, Boom.

Twee Gezustas ..	Steel	—	Rumpt	550	—
† x	..		Paris	57	225
m 5 Vessels	..		Antwerp	150ea	35ea
m x	,,	—	,,	150	35
3 Barges	,,	—	—	400	—
m Sirène	..	—	Boom	2	24
m Tètar I	,,		Antwerp	2	50
m Loraine de Dietrich	..		Paris	2	30
m Electroi	..	—	Brussels	5	15
m Neptune	..	—	Antwerp	6	18
m x	..		..	2	15

By Aug. Hamman, Ostend.

L'Avenir	Wood	Dandy Cutter	Ostend	58	—
De Zonge Ferdiuand ..	,,	,,	,,	46	
.. .. ..		Cutter	..	12	—

By Societe Anonyme John Cockerill, Hoboken.

‡ Zimga, Stern-Wheel	Steel	Congo	24	28	65IHP.
‡ 2 Combination Tugs	,,	,,		52ea	30 ,,
2 Barges	,,	Argentine	—	121ea	—
1 Barge	,,	,,	—	178 ,,	
2 Barges	,,	Turkey-in-Asia	—	120 ,,	—
7 Lighters ..	,,	Egypt	—	88 ,,	—
2 Lighters ..	,,	Brazil	—	56 ,,	
2 Lighters ..	.	Congo	—	5 ,,	—
6 Caissons ..	,,	Antwerp	—	220 150	,,
‡ Stern-Wheel ..	,,	Congo	24	30	65IHP
† Tug, 2-screws ..	,	Siberia	175	180	200 IHP.
† Paddle-Wheel Tug	,,	,,	283	308	400 IHP.
‡ Deliverance VIII. Stern-Wheel ..	..	Congo	27	30	65 IHP.
1 Barge, Lighter	..	Argentine	—	88	
1 ..	..	Congo	—	17	—
5 Barges	..	Siberia	—	817	—
1 Barge ..	..	Congo	—	52	—
1 Barge ,	,,	Siberia	—	615	

DUTCH.

By The Arnhem Company, Arnhem.

Name of Vessel	Built of	Class	Owners	Dis Tons	I.H P
† Rheingold	—	Tug	Mainz	130	275
† Jakob Hugo.. ..	—	.	Coblenz	130	275
† Prins	—	..	Chatelet	120	275
† Pax	—	..	Engis	120	275
c Alto Uruguay ..	—	..	Uruguay	61	120
† Presto III.	—	.	Dordrecht	65	105
† Harmonie	—	.	,,	55	80
† Prevoyance	—	..	Antwerp	225	425
† Liena II. . ..	—	..	Dordrecht	100	360
† Rosalie	—	..	Baesrode	90	125
† Direktor Prins ..	—	..	Düsseldorf	260	500
† Caroline .. .	—	Tug	Antwerp	Machinery Only	200
† Presto II. . ..	—	,,	Dordrecht		60
† Julliette	—	,	Antwerp		200
* Biebrich . .	—	Passenger Steamer	Biebrich		225
† Mala (Old vessel)		Tug	Düsseldorf		300
† Jacob	—		Dordrecht		400

* Compound. † Triple. *m* Motor.
‡ Twin Compound. *c* Single Cylinder.

By Gebr. G. & H. Bodewes, Martinshoek.

Name of Vessel.	Built of	Class.	Owners	G T. Regis	I H P.
4 Vessels	Steel	—	Elmshorn	200ea	—
Jetta	,,	River Lighter	Schiedam	725	—
Vier Gebroeders ..	,,	Motor vessel	Hansweert	85	20
De Goede Gunst ..	,,	,,	Uithoorn	40	20
Vineta	,,	Barge	Abbenfloth	110	—
Johanna	,,	,,	Estebrugge	120	—
Maria & Anna ..	,,	,,	Burnkrug	110ea	—
Constan Johan ..	,,	River Vessel	Bergenop Zoom	950	—
De Gebroeders ..	,,	—	Hooquand-	48	—
Aderika	,,	Motor Vessel	Katwijk Zee	105	20
Geertruida Margarita	,,	,,	Amsterdam	106	20
Onduneming ..	,,	,,	Groningen	190	—

By H. H. Bodewes, Millingen.

Wille Gottes ..	Steel	Rhine ships	Germany	700	—
Spera in Deo ..	,,	,,	,,	1100	—
Fendel 61	,,	,,	..	900	—
,, 62	,,	,,	,,	850	—
,, 63	,,	,,	,,	1600	—
Lay	,,	,,	,,	650	—

By Bonn & Mees, Rotterdam.

† N. A. S. W.X. ..	Steel	—	Rotterdam	300	180
† 2 Vessels	,,	—	Boulogne	260ea	430ea
† 2 Vessels	,,		,,	265ea	470ea
† Menado	,,	—	Rotterdam	5000	2500

By Jonker Gebr. Scheeps Baumeisters, Kinderdijk.

No. 309..	Steel	Lighter	Germany	1400dw	—
Jonker II.	,,	,,	Holland	1500	—
Excelsior	,,	,,	Rotterdam	1450	—
* Anna	,,	Tug	..	—	100
* Marseillais 18 ..	,,	Sea tug	Marseille	—	325
* Nijverheid II. ..	,,	Cargo boat	Holland	100dw	75
* Nos. 312 & 315 ..	,,	Tugs	Rotterdam	—	100ea
* No. 318..	,,	Sea Tug	,,	25dw	150

By K. J. Koopman, Dordrecht.

* Johannes Gerardus	Steel	Tug	Vreeswyk (Holland)	—	160
* Agnes	,,	,,	London	—	350
† Hollander	,,	,,	Dordrecht (Holland)	—	300
* Kever	,,	..	Maasslius	—	100
† Rienzi	,,	..	Rouen (France)	—	250
† Prooessus II. ..	,,	,,	Roseum (Holland)	—	325
* Cornelia II.	,,	,,	Dordrecht	—	65

By J. Meyers Shipbuilding Co., Zalt Bommel.

				Cargo capacity	
One Tanklighter ..	Steel	—	Dutch	80	—
m 1 Motor lighter ..	..	—	.	85	45
2 Sailing Ships ..	..	—	Germany & Holland	290	
2 Channel Lighters	..	—	Belgium & Holland	700	—
3 Rhine Barges ..	..	-	Germany & Holland	2050	—
* 1 Paddle Passenger Steamer		—	Germany	400	225
1 Hopper Barge ..	.	—	Holland	180	—
2 Pontoons	.		.	80	—
† Elstad, Cargo Steamer	—	—	Arendal (Norway)	1600	600

* Compound. † Triple. *m* Motor.

By Maatschappij voor Scheeps-en-Werktuigbouw, "Fijenoord," Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G T Regis	I H.P.
a Grotius (Mail Steamer)	Steel		Amsterdam	5860	4500
† S'Jacob	,,	—	Batavia	2907	1600
† Van Nek	.		,,	2907	1600

By B. A. Mittendorf, Dedemsvaart.

Rien Sans Dieu	Steel	—	Aak	115	—
Twee Gebroeders	,,	—	,,	132	—
Helenhaezer	,,	—	,,	120	—
Cosmopoliet	,,	—	Klipper	160	—
Bertha Johanna	,,	—	Aak	100	—

By The Nederlands Shipbuilding Co., Amsterdam.

a Vondel	Steel	—	Amsterdam	5846	4000
† Vulcanus	.	—	,,	1817	1000
† Suriname	,,	—		2900	2600
Simson	,,			135	—
Floating Derrick * Dredger	,,	—		—	60

By A. J. Otto & Sons, Krimpen a/d. Yssel.

Bremen 101, 102, 103, 104, 105, 106	Steel	—	Bremen	750 n	—
* Vreeswyh	,,	—	Rotterdam	— ,,	175
Dora	,,	—	Millingen	1100 ,,	—
* Ysel VI.			Gouda	— ,,	150
Geertruida	,,	—	Millingen	1100 ,,	—
2 Vessels	,,		Bangkok	— ,,	—
1 Vessel	,,	—	Coblenz	1300 ,,	—

By J. J. Pattje & Son, Waterhuizen, near Groningen.

Heinrich Linnemann	Steel	2 mast Schooner	Hamburg	153 n	—
Marie	,,		Amsterdam	80 ,,	—
Herman Linnemann	,,	3 mast Schooner	Hamburg	247 ,,	

By Rotterdamsche Droogdok Maatschappij, Rotterdam.

† Suez	—	Bucket Dredger	Suez	400	400
† St. Petersburg	—	Suction Dredger	Rotterdam	600	650
† Venus & Vesta	—	Steam	—	1900ea	1100ea
† Constance Catherine	—	,,		1200	900
† Madeleine		.	—	1200	950
† Wilhelmina		,,	—	1200	850

By The Royal Shipbuilding & Engineering Co., De Schelde, Flushing.

† Kawi	Steel	—	Rotterdam	4877	3650
† Sumatra			Amsterdam	5,000	2,500
† Zeeslang			Dutch Govt.	83	83
† Noordwijk	Machinery only.			—	1,100
† Heemskerck				—	6,800

By P. & A. Ruztenberg, Waspik.

Camille	—	—	[illegible]	[illegible]	—
Avontuur II.	—	—	Waspik	[illegible]	—
Maria	—	—	,,	[illegible]	—
Wilhelmina	—	—	Colijnsplaat	800	—

By J. Smit & Cgn., Alblasserdam.

† Noordwijk	Steel	Schooner	Rotterdam	[illegible]	[illegible]

Van Vliet & Co., Hardinxveld.

R.S.G. 7 & 8	Steel	Barge	Rotterdam Duisburg	1830ea	
No. 60		Steamer	London	780	
N.V. Emma 3		Barge	Rotterdam	[illegible]	

* Compound. † Triple. a Quadruple.
n Including Erections.

J. & K. Smit's Scheepswerven, Kinderdijk and Krimpen, a/d Lek.

Name of Vessel.	Built of	Class	Owners.	G. T. Regis.	I H.P.
* Useful I. & II.	Steel	1 mast	London	60ea	200ea
Amsterdam	,,	Suction Dredger	Valparaiso	380	500
* Hercules II.	,,	Floating Derrick Pontoon	Dordrecht	Steam winches	To lift 50 tons
* Nederland I. & II.	,,	Bucket Dredgers	,,	350ea	200ea
* Suction Dredger	,,	Suction Dredger	Port Said	150	300
* Telegraaf VIII.	,,	Cargo Steamer	Rotterdam	275	250
* Havendanst IV.	,,	Passenger Steamer	Amsterdam	70	60
* Nederland III.	,,	Bucket Dredger	Dordrecht	225	150
* Maassluis and Katendrecht	,,	Tugs	Rotterdam	65ea	150ea
* De Leek II.	,,	Passenger Steamer	de Leek	45	40
‡ Eclaireur	.	Steam Launch	Kinderdijk	30	110
† No. 604	.	Suction Dredger	Hildtrecht	400	800
† No. 605	,,	Bucket Dredger	,,	350	200

By A. Vuijk & Zonen, Capelle a/d, Yssel.

7 River Barges	Steel		Bremen	650 d.w. ea	
Minden 53 & 54	,,	—	Minden	650 ,, ea	
2 River Barges	,,	—	Rotterdam	13,00[illegible] ,, ea	
† Carl Lehnkering	,,	,,	,,	3,625 ,,	
Dina	,,		Konigswinter	1,405 ,,	
† Thora & Nicholas	,,	—	Tonsberg	1,125 ,, ea	
Bremen 138 & 144	,,	—	Bremen	700 ,, ea	

By N. V. Werf, v/h Rijkee & Co., Rotterdam.

† Atlas	Steel	Tug	Amsterdam	[illegible] n	1,500
† Thames	,,	,,	Rotterdam	500 ,,	1,200
† Zeeland	.	Collier	,,	1,290 ,,	900

By The Wilton Engineering and Slipway Co., Rotterdam.

* Rotterdam	Steel	—	Valparaiso	[illegible]	550
* Drydock	,,	—	Rotterdam	75	250
* Brandan & Djamki	,,	—	Batavia	250ea	250ea
m Nadia	,,	—	Rotterdam	8	40
* Lancka	,,	—	Hakon	10	40
† Bruxelles 45	,,	—	Malines	260	600
† Remolcador 2	,,		Huelva	90	250

By J. Drewes & Co., Ijzeren Scheepsbouw big Groningen.

† Admiral de Ruyter	Steel	—	Ymuiden	—	275
* Agnes	,,		Hamburg		315
Henrich	Gal. Steel		Senegal		—
Henrich II	.				
Westitrih 9, 10	.		,,	—	
Emmy					
Westitrom 11		—		—	—
* Vesta	Steel		Bremen		275

By Firma A. F. Smulders, Schiedam.

* Steam Hopper	—		Suez	750	[illegible]
* 3 Bucket Dredger	—		Spain	[illegible]ea	[illegible]
* Bucket Dredger	—	—	British	[illegible]	[illegible]
2 Hopper Barges	—			[illegible]ea	—
† 2 Bucket Dredger	—	—	Dutch	320ea	[illegible]ea
* Tug Boat	—	—	Argentine	[illegible]	250
* Coal Elevator	—		Dutch	[illegible]	[illegible]
Hopper Barges	—		French	[illegible]	—
* Tug Boat	—		,,	110	250
* Dredger	—		,,	280	250

* Compound. † Triple. †* Twin Compound. m Motor.
n Including Erections.

By Wed. C. Boele & Son, Slikkerveer.

Name of Vessel	Built of	Class.	Owners.	G T Regis	I H P
Richard IV. ..	Steel	—	Antwerpen	2,635	—
Ut Deus Vult		—	Deutschland	1,002	—
Apollo			Rotterdam	1,496	
No. 135		—	Bremen	600	
No. 137		—	..	600	
† Marmo		—	Dunkerken	—	300
† Gustatin III. ..		—	Deutschland	—	175

LIST OF VESSELS ENGINED IN 1907.

By The Alblasserdamsche Engineering Works, Alblasserdam.

Name of Vessel	Builders	I H P	Press. lbs
† Toh. Knipscher I.	Old Vessel .	375	200
† Madeleine	Bonn & Mees .	440	180
* Nederland I. & II.	T. & K. Smit ..	220ea	150ea
* Commerce	Gebrs v.d. Windt	320	120
† Gouda	Old Vessel ..	(300) 150 (20)	180
† Antoinette	Bonn & Mees	485	200
† Edevia Mendi ..	Jonker & Hans ..	(140T) (140T)	180
* Marseillais 18 ..	Gebrs Jonker	320	120
† Atlas	L. Smit & Zoon ..	550	100
* Marine	Wed. C. Bode & Zoon	320	120
† Dredger	L. Smit & Zoon	(400)	180
† ..			
† Flandre	N. V. Wert Th. Rijkee and Co.	430	180

By The Kinderdijk Engineering Works, Kinderdijk.

Name of Vessel	Builders	I H P	Press. lbs
* N. A. S. M. x. ..	Bonn & Mees . ..	15	120
† Prins Hendrik ..	L. Smit & Zoon .	550	150
* No. 522..	T. & K. Smit's Scheepswerven..	180	100
* Nederland III. ..		150	120
* 2 Vessels	.. .	150ea	105ea
* de Leek	. .	40	90
‡ Eclaireur	.	100	90

By Stork Bros. & Co., Huegelo.

Name of Vessel	Builders	I H P	Press. lbs
* 6 Gold Dredgers ..	Wert. Conrad Haarlem	80ea	90ea
* 1 Bucket Dredger	..	180	105
* 1 Tug Boat		150	120
* 1 Suction Dredger	.	85	105
† 1 Bucket Dredger	.	325	160
† 1 Suction Dredger	.	400	160
†		150	160
* 2 Suction Dredgers		180ea	110ea

By Wilton's Engineering & Slipway Co., Rotterdam.

Name of Vessel	Builders	I H P	Press. lbs
† Thames, Sea Tug	Rykee & Co	200	185
† Zeeland, Cargo Steamer ..		800	180

GERMAN.

By Actien Gesellschaft "Neptun" Schiffswerft und Maschinenfabrik, Rostock.

Name of Vessel	Built of	Class	Owners	G.T Regis	I H,P
† Margarete Russ ..	Steel	Steam	Hamburg	2,700 *n*	1,000
† Achaia		.	Bremen	2,730 ,,	1,000
† Claus Horn		.	Lübeck	2,690 ,,	1,000
Yacht		,,	—	9 ,,	—
† Minna Horn .		,,	Lübeck	2,700 ,,	1,000
† Micklenburg . .		,,	Wismar	2,660 ,,	1,000
† Anna Menzell		.	Hamburg	2,760 ,,	1,100
† Luise Menzell .			.	2,760 ,,	1,100
† Fsiedrich Arp			.	1,624 ,,	700
† George Harper		.	Rostock	1,600 ,,	700
† Schwan . .			Bremen	1,212 ,,	1,000
* 4 Vessels			Kiel	110ea	80ea

* Compound. † Triple. ‡ High Pressure.
Including Erectionn.

By Actien Gesellschaft "Weser," Bremen.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I H P
a Uhenfels	Steel	—	Bremen	5,576 *n*	2,400
a Lützow		—	..	8,792 ,,	5,800
† Knock		—	Emden	340 ,,	500
† Minendampfer B. .		—	Wilhelmshaven	2000 ,,	—
Anlegeponton für ..		—	—	—	—
Hafen II. Bremen .		—	Bremen	—	—

By Blohm & Voss, Hamburg.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I H P
† Rhakotis	Steel	—	Hamburg	6,982 *n*	3,100
a Cap Arcona		—	..	9,831 ,,	7,600
t Dresden (Cruiser .		—			—
a Santa Elena		—	.	7,320ab ,,	2,800
2 Dock Pontoons .		—	—	8,500 ,,	—

By Flensburg Shipbuilding Co., Ltd., Flensburg.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I H P
Plauen	Steel	—	Hamburg	4,210	2,200
Neumunster		—	.	4,224	2,200
Schlesien		—	Bremen	5,536	2,550
Bianca		—	Hamburg	1,054	550
Harzburg		—	Bremen	4,677	1,800
Furth		—	Hamburg	4,238	2,200
Osnabruck		—	..	4,240	2,200
Hanau		—	..	4,213	2,200
Santa Maria		—	..	7,450ab	2,500

By Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I H P
† G 137 .	Steel		Kiel	550	10,000
† Nordsee		-	Lübeck	4,440	1,800
m Motor Boat		-	Valparaiso	10	30
m 100 Barges		—	Kiel	7,300	1,000

By Heinrich Bradenburg, Hamburg.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I H P
No. 214..	Steel	—	Hamburg	—	175
* Prompt		Tug	..	44	—
* Nos. 216 & 217 ..	Wood	Launch	Foreign	7ea	18ea
* Nos. 218 & 219		..	Hamburg	7ea	18ea
* Gustav Wilhelm I.	Steel	Tug	.	32	175
No. 221..		Boat	Foreign	—	—
* Nos. 222 & 225 (4)	Wood	Launches	.	7ea	18ea

By R. Holtz, Harburg.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I H P
30 Vessels	Steel	—	Foreign	642 *n*	1,758ind.
3	Wood	—		26 ,,	75 ,,
m 2	Steel	—		25 ,,	27eff
13 Lighters	..	—	.	270 ,,	—
m 2 Vessels	Wood	-		15 ,,	26eff
3 Lifeboats ..	Steel	-	.	14 ,,	—
2 Vessels		—	German	51,,	112ind.
12	Wood	—		108,,	216 ,,
m 6 ,, ...	Steel	—	.	39,,	46eff

By C. Luhring Schiffswerft-u-Trokendock Kirchammet Warden Va, Brake, I.O.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I H P
* No. 131.. . .	Steel	—	Bremen	410	100
Glückauf .. .		—	Brake	125	—
Emma Linnemann ..		—	Harburg	205	—
Willy		—	Hamburg	303	—
2 Vessels		—	Bremen	410ea	—

By J. L. Meyer, Papenburg.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I H P
* Wilgum	Steel	-	Emden	78	240
* Doña Ida			Buenos Ayres	288	100
Baunummer 218		-	Leer	105	40
Duodezima		-	Rio Grande do Sul	164	—
* Westfalen		-	Emden	385	700
* Hannover			Norden	148	150
† Daunsteld		-	Wilhelmshaven	200	500
* Passat			Kiel	180	400
* Baunummer 224		—		7	20
Prähme 57-58 ..			Emden	56	—

* Compound. † Triple. *a* Quadruple. *m* Motor. *t* Turbine.
n Including Erections.

By Nuscke & Co., Stettin-Grabow.

Name of Vessel	Built of	Class	Owners	G. T. Regis	I H P
† Fouers Pull ..	.. Steel		Flensburg	720	450
† Rotik ..			St. Petersburg	1 203	800
3 Lighters ..				7	
1 Vessel ..			Greifenhag	35	
2 Vessels ..			Stettin	170	
† Hohenzollern				98	350
† Mariamsa				1 038	500
2 Vessels				170	

By Reiherstieg Schiffswerfte und Maschinenfabrik, Hamburg.

† Marie Maschmann	Steel	Schooner	Hamburg	1,743 *n*	900
**Gertrud Woermann		Twin screw		6,468 ,,	3,500

By Rickmers & Co., Bremerhaven.

† D. Andreas Rickmers	Steel		Bremerhaven	4,173	1,600
† Dorothea				4,177	1,600

By Schiffswerft von Henry Koch, Lubeck.

† Teo Pao	Steel	Schooner	Bremen	1,001	1,000
* Kana IV.			Flensburg	273	250
† Chiengmai			Bremen	1,815 ,,	850
† Patani ..				1,810	800
† Sikiang			Hamburg	1,043	1,050
Nos. 170 to 180 11 Barges				675	

By Georg Seebeck A. G., Bremerhaven.

† Franzius ..		Trawler	Bremerhaven	245	300
† Ehrenfels and Lichtenfels			Nordenham	250ea.	380ea
† Rhein & Fulda				250ea,	420ea
* Favorita Clara		2-Screw Steamer	Buenos Ayres	512 ,,	320
† Meteor & Polarstern ..		Trawler	Geestemunde	250ea.,	420ea
† Ferdinand				175 ,,	300
† Wirra ..			Nordenham	250 ,,	420
† Hay ..		Navy Tender		54[illegible] ,,	1,200
† Columbia		Tug Boat	Geestemunde	[illegible]	350
* Adolf ..		Trawler		[illegible]	[illegible]
† Arthur Brensing and Olbers			Bremerhaven	240ea.,	400ea
† 32 Trawlers ..				250ea,	300ea
† Jupiter ..			Geestemunde	257 ,,	420

By Stocks & Kolbe, Kiel.

m Arnold & Lüppel	Steel		Wellingdorf	18	[illegible]
No. 112 & 113				03	
No. 131 & 132				18	
No. 116 & 117	Wood		Sonderburg		
Nos. 118, 119, 125, 127, 133, 134 ..	Steel			03ea	
Nos. 126 & 123				42	
* No. 124 s.s. Kiel			Kiel	112	
m No. 128 Eider			Tönning	40	340H
m No. 130 Wacht			Eckernforde	75	140H
m No. 129 ..	Wood		Wellingdorf	—	[illegible]
No. 138 & 140	Steel		Hamburg	43	

By Joh. C. Tecklenborg A. G., Bremerhaven, Geestemunde.

† Santa Catharina	Steel	Steam		4,[illegible]	[illegible]
† Santa Lucia				4,[illegible]	[illegible]
† Planet ..				[illegible]	
† Venus & Mars				224ea,	1,[illegible]
† Odin & Thor				27[illegible]ea,,	45[illegible]
a Prinz Friedrich Wilhelm ..				17,[illegible]	24,[illegible]
† Rob. de Neufville				[illegible]	400

* Compound. ** Triple Compound. † Triple. *m* Motor. *a* Quadruple. *n* Including Erections.

By J. Thormahlen & Co., Elmshorn.

Name of Vessel	Built of	Class	Owners	G. T. Regis	I H P
Maria Dorothea	. Steel	Sail	Assel	80	
Anna ..	,,			70	—
Ann ..	,,		Dannbusch	75	
30 Lighters ..			Hamburg	3,360 ab.	—

By Bremer Vulkan, Vegesack.

† Arnold Amsinck	—	—	Hamburg	3,403	2,300
† Max Brock ..	—			3,403	2,300
† Kiel ..	—	—	Bremen	3,380	2,600
† Nannes	—	—		3,381	2,600
* Staar	—	—	Vegesack	67	70
† Gottingen ..	—	—	Bremen	3,451	2,650
† Greifswald	—			3,460	2,650
† Gotha	—			3,460	3,500
† Giessen	—			3,460	3,500
* Rabe	—	—	Vegesack	67	70
* Elster	—			67	70
† Machinery only					1,700

By T. G. Hitzler, Lauenburg (Elbe).

* No. 193 ..	.. Steel	Freight Steamer		300	250 IHP.
m Nos. 197-199		Motor Lighters		120ea	28ea
m Nos. 200-205 ..		Lighter Motorboats			22ea
No. 206 ..		Lighter	—	[illegible]	—
6 Lighters		,,	—	220ea	
m No. 210 ..		Motorboat	—	—	22
No. 214		Barge	—	—	—

By Howaldtswerke, Kiel.

† Lauting ..	.. Steel	1 Pole-mast	Tsingtau	394 ,,	450
† 6 Schooners			Copenhagen	1,426ea ,,	650ea
† Sosey ..				2,024 ,,	950
† Laboe ..		1 Pole mast	Kiel	257 ,,	650
† 3 Vessels ..			..	207ea,,	350ea
* 2 Vessels ..			..	130ea,,	200ea
† Kong Georg ..			..	3,412 ,,	650
† — ..			..	2,700 ,,	950
t Vulkan ..			..	1,800 ,,	1,400
* Strand ..			Friedrich	110 ,,	120
† ..				15 ,,	160
5 Pontoons			Kiel	300	

By Gebr. Sachsenberg of Rosslau & Deutz.

† Stachelhaus V. Buchloh		Rhine Steam Tug	Mülheim am Ruhr	300	650
* Lauenburg II...		Havel Steam Tug	Lauenburg	205	325
* President ..		.. Elbe Steam Tug	Hamburg	370	[illegible]
† Diplomat ..				542	600
* Iguassu ..		.. Freight Steamer	Curitiba	38	60
König Friedrich August ..		Elbe Steam Tug	Hamburg	333	800
† Undine		Havel Steam Tug		252	320
† Hertha			Spandau	252	320
Vorwärts ..		Steam Tug	Strasburg	52	100
* Hoffnung ..		Launch		10	48
* Friedrichsort		Pass. Steamer	Kiel	108	200
* 383		Dredger	Wilhelmshafen	428	900 / 300 / 50 / 50
384 ..		Launch	Wellingen am Rhein	32	
385 ..			Wilhelmshafen	[illegible]	
† Barbarossa		Steam Tug	Hamburg	[illegible]	320
387 ..		Coal Barge	Kiel	[illegible]	—

* Compound. † Triple. *m* Motor. *t* Turbine. Including Erections.

By Vulcan & Co., Stettin.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
t Stettin	Steel	Cruiser	Kiel	2,590 n	17,300
a König Wilhelm II.	,,	Fr. & Pass. Steamer	Hamburg	9,332 ..	7,200
† Aspis & Velos		T. Destroyer	Piräus	350ea ..	6,800ea
† V. 150, 151, 152, 153 and 154	,,	Torpedo	Wilhelmshaven	500 .	10,500ea

By G. H. Thyen, Brake a/d Weser.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
* Karl, Tug.. ..	Steel	—	Oldersburg	-	100
* Alma, ...	,,	—	Leer	146 n	100
* Clara, ...	,,	—	,,	146 ,,	100

Bremer Vulcan, Vegesack.

Name of Vessel	Built of	Class	Owners	G.T.	Regis	I.H.P.
a 2 Passenger Steamers			—	ab3,400ea	—	3,500ea
* Steam Tug				8	—	120
* 6 Trawlers			—	67ea		70ea
† 2 Steam Tugs				10ea	—	300ea
a Freight Steamer ..			—	ab 3,400		2,600
† ..	Machinery only					1,700

By Oderwerke Actien Gesellschaft, Stettin.

Name of Vessel	Built of	Owners	G.T.	Regis	I.H.P.
† Clara Charlotte	Steel	Kuschern	45		160
* Fortschritt ..	..	Stepenitz	105	—	160
* 2 Vessels	,,	Berlin	100ea	—	240ea
† Ems and Emden	..	Hamburg	699ea		400ea
† Claus	..	Stettin	302	387	250
* Demmin Paket	..	Demmin	245	—	210
† Schwenz	,,	Stettin	23		80
† Chr. Russ ..	..	Hamburg	974	1,067	650
† Spüler II... ..	..	Stettin	152	—	250
* Fairplay VII. and VIII.	..	Hamburg	93ea	—	300ea
† Cremon	..	..	1,060		650

LIST OF VESSELS ENGINED IN 1907.

By Buckau Engineering Works, Ltd., Buckau.

Name of Vessel	Builders.	I.H.P.	Press lbs.
†	T. H. V. Wichhorst, Hamburg	300	185

By the North German Lloyd, Bremerhaven.

Name of Vessel	Builders.	I.H.P.	Press lbs.
a Kronprinzessin Cecilie	Stettiner Vulcan, Stettin	45,000	213
a Kleist	F. Schichau, Danzig	6,000	221
a Goeben	Act. Ges. Weser, Bremen	6,000	221
a Schlesien	Flensburger, Schiffswerft	2,800	213
† Teo Pao	H. Koch, Lübeck ..	950	185
† Chiengmai	..	950	185
† Patani	..	950	185
† Sirius	J. Frerichs & Cie., Einswarden	500	185
a Göttingen	Bremer Vulkan Vegesack	2,800	221
a Greifswald	..	2,800	221
a Gotha	..	2,800	221
* Bremerhaven ..	J. Drewes & Cie., Groningen	100	142

DANISH.

By Actieselskabet Burmeister & Wains, Maskin-o.g. Skibsbyggeri, Copenhagen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis	I.H.P.
† Haakon	Steel	Schooner	Arendal	1,640 n	750
† St. Jan		.,	Copenhagen	2,478 .,	1,350
† St. Thomas and St. Croix ..		..	..	2,486ea	1,350ea
† Olaf		..	Arendal	1,051	750
† Valkyrien		1 mast	Copenhagen	339	625
† Bintang		Schooner	..	2,860 ,	1,150
† Herakles			Stockholm	406 ,	950

* Compound. † Triple. *a* Quadruple. *t* Turbine. *n* Including Erections.

By Actieselskabet Kjobenhavns, Flydedok o.g. Skibsværft.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
† Hebe & Ellen ..	Steel	—	Esbjerg	775ea	550ea
† Svava	,,		Kjobenhavn	160	425
* Emilie		—	..	110	125
† Yugala	..	—	Bangkok	760	400
* Hesselo	..	—	Kjobenhavn	175	200
† Frederiksholm	..	—	..	350	325

By Elsinore Iron Shipbuilding and Engineering Co., Elsinore.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
† Jens Bang ..	Steel	Steam	Aalborg	1,543 n	650
† Emanuel	..	..	Marstal	1,284 ..	650
† Fulton & Newton	..	..	Copenhagen	1,547ea.,	650ea

By J. A. Petersen, Marstal.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
Viking	—	—	Marstal	82	—

FINNISH

By The Engine and Bridge Building Co., Helsingfors.

Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
* Storbrotten ..	Steel	Steam Lightship	Abo (Marietramn)	370	200
* Julle		Screw Tug	Willmanstrand, Lake Saima	31	75
* Udalog		Paddle Tug	Blagovestochschensk, Siberia	250	300
Provovnij	..		..	250	300
Boris	..		..	280	450

W. Rosenlew & Co., Bjorneborgs.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
Optima ..	Steel		Russian	174	—

By J. D. Stenberg & Sons, Helsingfors.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
* Maggie	Iron		Vuotjarvi	19ab	140

SWEDISH.

By Bergsunds Mekaniska Verkstads Aktiebolag, Stockholm.

Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
* Hammar, Cargo Steamer for trade on Gota Kanal	Mild Steel	Schooner	Hammar Sweden	250d.w. 123 netto	180
† Torpedo Boats Nos. 8 and 9			Stockholm	57 dis ea	800ea

By Eriksbergs Mek. Verkstads Aktiebolag, Goteborg.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
* Styrso	Steel	Screw Steamer	Goteborg	75	280
* Jössefors		..	Jössefors	192	120
* Eriksberg		..	Goteborg	under 40	53
* Turisten		..	Trollhätten	107	180
† Wasa		.	Goteborg	441	350

By Goteborgs Nya Verkstads Aktiebolag, Goteborg.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
† Urd & Carl ..	Steel	Cargo	Goteborg	640ea	400ea
* Ran	..	Tug	Landskrom	30	75
† Klippan	..	Cargo	Goteborg	500	325
3 Motor Boats	—	—			

By Helsingborgs Varfs Aktiebolag, Helsingborg.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
† Steamer, Hull No. 30	Steel	Schooner rigged	Helsingborg	900ab n	500
Sea-going Barge				210ab	

By Kockums Mekaniska Werkstad Aktiebolag, Malmo.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
† Prinsessan Margareta ..	Steel	Schooner	Malmo	1,376	2,200
† Vale	.	Destroyer	Swedish Govt.		7,500

* Compound. † Triple. *n* Including Erections.

By Lindholmens Verkstads Aktiebolag, Goteborg.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Polcirkeln..	.. Steel	—	Stockholm	1,927 *n*	1,100
† Stegeborg	..	—	Mem	700 ,,	450
† Dahlia	.. .	—	Gothenburg	1,078 ,,	600

By The Lodose Wharf Co., Ltd., Lodose, Goteborg.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
* Cyrene	Steel	Schooner	Gothenburg	—	200
* Arete..	..	..	.	—	200

By Motala Verkstads Nya Aktiebolag, Motala.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
* Skärgärden	.. Steel		Stockholm	80	260

By Oskarshamns Mekaniska Verkstads och Skeppsdockas Aktiebolag, Oskarshamns.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
Lighter	.. Steel	—	Stockholm	163 *n*	
Pontoon ..			.	79	
Lighter ..				5[illegible]	
* Yarl ..		Schooner	Oskarshamns	245	3[illegible]
m Orion, Auxil. 3 m			Stockholm	266	75

By The Stockholm Transport Co., Ekensburg.

Name of Vessel	Built of	Owners	G T Regis	G T inclu erect	I H P
m Liss	Steel 3 mast Schooner	Stockholm	127	130	75
m Stromakaren ..	Steel		38	4[illegible]	45

LIST OF VESSELS ENGINED IN 1907.

Aktiebolaget Gefle Verkstader, Gefle.

Name of Vessel	Builders	I H P	Press lbs
* Lidingäfärjan 2	Aktiebolaget Gefle Verkstäder ..	1[illegible]	1[illegible]

By Rob. Sjostrom, Gefle.

Name of Vessel	Builders	I H P	Press lbs
* Bōnan II...	.	120	140

NORWEGIAN.

By Akers Mek. Værksted, Christiania.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Anita	Steel		Kristiania	1 172 *n*	740
† Lauritz Berg ..			Mjoatjord Iceland	100	370
† Gisla			Kristiania	1,360 ,,	850
† Linga Nos. 268 and 269 ..			Leith	109ea,	370 ea
† Amatomi Maru .		—	Tokyo	114 ,,	370
† Telo		—	Fredriksvarn	655	550
† Daito Maru ..		—	Kristiania	113 ,,	370
† Marusan Maru..		—	Nagasaki	114 ,,	370
† Blaamanden .	..	—	Bergen	954 ,,	700
† Sydvaranger ..		—	Kirkenes	150	350
5 Vessels .. . (engines only)					5 250

By Aktieselskabet Fredriksstad Mek. Verkstad.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Kang Sigurd	Steel	Steam	Kristiania	1 227 *n*	1 050
† Brüssel ..	.	,,	.	1,489 ,,	1 150
† Brabant		.		1,492	1,200
† Sterling .. .		.	.	1 323 ,,	1 350
† Clothilde Cuneo.			Tonsberg	1,200 ,,	1 1[illegible]
† Ena		..	Kristiania	1,125	700
† Trip 6 .. .			Fredriksstad	45	7[illegible]
† Framnæs (engines only)				—	1 400

By Bergens Mekaniska Verkstad A.B., Bergen.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Ada .. .	Steel	—	Christiania	2 [illegible]	280
† Aslaug	. .	—	Haugesund	1 104	720
† Grau .	.		Lyngör	1 153	720
† Aud ..			Bergen	1 102	720
† Thorsa	.	—	Arendal	1,134	700
† Hero	.	—	Aalesund	1 1[illegible]5 ,,	720

By Stavanger Stoberi & Dok, Stavanger.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Geiranger	Steel	Schooner	Bergen	1 081 *n*	680
† Ravn.. .				997 ,,	900 ab

* Compound. † Triple. *m* Motor *n* Including Erections.

By The Christiansand Mechanical Works, Christiansand.

Name of Vessel	Built of	Class.	Owners	G T Regis	I H P.
* Havskaaren .	Steel	Schooner	Norway	103 *n*	160
* Björnulf ..	,,	..	..	104	160
* Thorulf	,	..		105 ..	160
* Ornen .	.	,,	..	107 ..	160
* Erling ..	.	.	.	101 ..	160

By Laxevaags Shipbuilding & Engineering Co., Bergen.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Ryvarden	Steel	—	Haugesund	1,104 *n*	650
† Dronning Maud			.	1,102 ..	650
† Baltic .. .	..	—	Bergen	1,054 .	650
† Hekla	.	—		—	650
† Frances		—	..	1 110 .	675
† Pollux built by Fevig .. .	.			—	800
† Sirius, old ship..					900

By Nylands Værksted, Christiania.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Eidsfos	Steel	—	Christiania	1,219	650
† Jas. S. Cuneo ..	..	—	..	874	700
† Rosario di Giergio ..		—	Flekkfjord	1,037	850
† Borga	..		Christiania	1,046	700
† Gunner Hamundarsan ..	,,	—	Iceland	117	280
† Queen Alexandra — ..	..		Christiania	112	280
† Njall	.	—	Iceland	117	280
† Star	..		Christiania	818	550
† Biscaga		—	..	1,476	900
†*Frogner .. .			.	1,475	900
† Holmestrand ..	.	—	Holmestrand	170	280
† Sueva Maru ..		—	Christiania	112	280

By Porsgrunds Mek. Værksted, Porsgrunds.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
* Mabel — ..	Steel	Schooner machinery aft	Kristiania	585 *n*	350
* Rusla .	Steel	Tug	Cletos	72 ,,	150
† Donstad .. .		Quarter deck	Arendal	698 ,,	450

By Trondhjems Værksted, Drontheim.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Bjarko .. .	Steel	Steam	Tromsö	286 *n*	270
Ivanhoe		..	Trondhjem	1,136 ,,	680
Inger ..		..	Trondhjem	1,136 ,,	680
Ullensvang	.	.	Bergen	470 ..	600
Azira ..	.	..	Bergen	1 130 ,,	680

AUSTRIAN.

By The Austrian Lloyd, Trieste.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Baron Beck and Palacky ..	Steel	2 Pole masts	Trieste	3 891ea	2,800ea
† Graz	..		..	3,891	3,200

By Marco U. Martinolich, Lussinpiccolo.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Pescatore	Steel	Tug	Fiume	110 *n*	280
‡‡San Giorgio ..	,,	Pass. Steamer	Venezia	125 ,,	310
† Maros		—	Fiume	560 ..	850
† Szamos		—	..	150 ,,	450
* Alessandro Moschim		Paddle Tug	Venezia	400 ,,	500

By Stabilimento Tecnico Triestino, Trieste.

Built and delivered during 1907: 7 ocean going torpedo boats of 200 tons displacement and 3,000 I.H.P. each; 2 torpedo boat destroyers of 400 tons displacement and 6 000 I.H.P. each; battleship Erzherzog Ferdinand Max, of 10,630 tons displacement and 17,000 I.H.P. for the Austro-Hungarian Navy; 2 armoured river guard vessels, of 680 tons displacement and 1 800 I.H.P., for the Roumanian Navy; passenger steamer Senj, 344 tons gross and 600 I.H.P., for Fiume; tugboat Bravo, 110 tons gross and 400 I.H.P. for Trieste; motor launch Primo 14 tons gross and 120 I.H.P., for Trieste.

* Compound. † Triple. ‡‡ Twin Compound.
n Including Erections.

HUNGARIAN.

By Danubius Shipbuilding and Engineering Co., Ltd., Budapest.

Name of Vessel	Built of	Class	Owners.	G T Regis	I H P
* Kazán	Steel	—	Budapest	370	800
* Razelm	,,	—	Galatz	45	100
19 Lighters ..	,,			13 700	—
1 Motor Boat ..	,,		Wien	—	60 eff. hp.

By Erst Ku K. priv Donau Dampfschifffahrts Gesellschaft, Budapest.

* Grain Elevator	Steel	—	Vienna	145 n	75
† Tug s.s. Sulissa	,,		,,	128 ,,	350
10 Barges ..	,,		,,	565 ,,	—
5 Barges			,,	338 ,,	—

By The Lazarus Works (Stabilimento Lazarus), Fiume.

* 3 Tugs	Steel		Pola	28 dis. ea	85 ea

ITALIAN.

By Amerigo Gori, Leghorn.

Name of Vessel	Built of	Class	Owners	G T. Regis	I H P.
Bianca Giulia ..	Wood	Sailing Brig Vessels	Leghorn	256	
Annunziata ..	.	..	.	94	
Dina di Lorenzo	..	..	.	99	-
Paolina L. ..	.	..	..	97	
Andrea	..	.	..	98	
Corrado ..	Wood	3-masted Schooner		98	—
Angelita Pu ..	Steel	..	Genoa	270	—

By N. Odors & Co., Cantieri de Dore, Genova.

a Re Vittorio ..	Steel	—	Genoa	7,800 n	7,500

Twin-screw for passengers.

By Societa Anonime Gio Ansaldo Armstrong Co., Sestri, Ponente.

† Artigliere T. B. Dest	Steel	—	Italy	334	6,000
† Lanciere	,,	—	,,	334	6,000
* Ramon Corral ..	..	—	Veracruz	103	220

By Societa Esercizio Bacini, Genoa.

† Principessa Tolanda	Steel	—	Spezia	9,000	10,000ab

By Cantiere Navale De Muggiano, Spezia.

Name of Vessel	Built of	Owners	G.T Regis	G T inclu erect	I H P
a Duca degli Abruzzi	Steel	Genoa		7,850 n	7,200
a Duca di Genova	,,	,,	—	7,850 ,,	7,200

By E. Moseati, Salerno.

Carmelina	Wood	Salerno	35	—	-
S. Giuseppe O.		,,	59		—
Vergine di Pompei .		,,	150	—	—

By Ingri. V. Coretti & C. Parodi, Leghorn.

* Mondego . .	Steel	Buenos Ayres	18	18	80
Catepa ..	..	.	20	26	—
Angelita P. .		..	312	270	—

SPANISH.

The Euskalduna Shipbuilding Co., Bilbao.

Name of Vessel	Built of	Class	Owners	G T Regi	N H P
† Udala mendi ..	—	Schooner	Bilbao	2,900	246

GRECIAN.

By John M'Dowall & Barbour, Piroes.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
* Barge .	Steel		Constantinople Ottoman Gvt.	—	250

a Quadruple. * Compound. † Triple. n Including Erections
n Including Erections.

HONG-KONG.

By W. S. Bailey & Co., Hong-Kong.

Name of Vessel.	Built of	Class.	Owners.	G T. Regis.	I H.P.
Teakwood Water Boat	Teak	—	Hong Kong	80	—
m Petrel	—	Motor	Canton	20	45 B.H.P.
Iron Towing Barge (2) ..	Iron	—	—	300	—
f 7 Vessels	Teak-wood		Canton	20ea	50ea
‡‡ Bailey No. 2 ..	Teak	—	Hong Kong	17	40
‡‡ Pinnace ..	,,	—	Canton	10	30
f Loong Seung ..	Steel	Cruiser	,,	160	260
Towing Lighters (2)	Teak		Hong Kong	240	—
m Motor Launch .	,,	—	Borneo	8	20 B.H.P.
Bulk Oil Barge (Towing) ..	Steel		Hong Kong	320	—

By Geo. Fenwick & Co., Ltd., Hong-Kong.

‡‡ Yvorme	Steel	—	Haiphong	—	120
Clemence	,,		..		—
Six Barges ..	Wood		Hong Kong	75 tons D.W.	

By Hong-Kong and Whampoa Dock Co., Ltd., Hong-Kong.

* 4 Vessels	Steel	Steam	Haiphong	160ea	120ea
Nos. 411, 426 ..	Wood	Sail	Hong Kong	604	—
* J. M. Jewell ..	Steel	Steam	Manila	60	180
* Tai Luk		,, .	Hong Kong	145	90
* No. 430	Wood	..	,,	45	60
* No. 434	Composite	..	Singapore	54	180
* No. 440	Wood	..	Hong Kong	20	70
† No. 431	Steel	..	.	365	1,100

STRAITS SETTLEMENTS.

By Riley, Hargreaves & Co., Ltd., Singapore.

Name of Vessel	Built of	Class	Owners.	G T Regis.	I H.P
Lighter	Wooden	Oil	Singapore	45	—
* Otto	Steel	Stern wheel	Batavia	66	200
* Launch	Wood	Screw	Singapore	19	60
* Launch	Wood	Motor	,,	5	45 B.H.P.
* Dredger	Steel	Screw	,,	127	215
Lighter	Wood	Screw	,,	36	—
2 Lighters ..	Wood	,,	..	85ea	100ea
2 Lighters ..	Wood	—	..	76ea	76ea
m 1 Lighter	Wood		,,	78	32 B.H.P.

By Tanjong Pagar Dock Board, Singapore.

* Mina	Wood	Screw Launch	Singapore	45 n	140
m Launch ..	Steel	,,	Lankat	34 ,,	100
m ,, .	,,	,,	,	7 ,,	20
* Vedette	Wood	Screw	Singapore	18 ,,	45
* Wilhelmina ..	Steel	Screw Steamer	Borneo	61 ,,	175
	—	Sail	Manila	7 ,,	—
7 Lighters ..	Wood		Singapore	17ea ,,	—
21	..	—	—	29ea ..	—

AUSTRALIAN.

By Adelaide Steamship Co., Adelaide.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Echunga		Steam	London	4,500ab	300 N.H.P.
† Urilla				2,000	

By Morrison & Sinclair, Balmain, N.S.W.

* Lady Carrington	Wood	Ferry Steamer	Sydney	-	450

* Compound. † Triple. f Compound Non-Condensing.
m Motor. ‡‡ Compound Surface Condensing.
n Including Erections.

AMERICAN.

By the American Shipbuilding Co. (All Yards.)

Name of Vessel.	Built of	Class	Owners.	G.T Regis	I.H P.
† Matthew Andrews	Steel	—	Fairport	7,000	1,760
† Jay C. Morse ..	,,	—	,,	6,600	1,760
† Hugh Kennedy .	,,	—	,,	7,000	1,760
† J. H. Bartow ..	,,	—	Erie	6,300	1,600
† Charles O. Jenkins	,,	—	Fairport	6,300	1,600
† Favorite	,,	—	Duluth	300	2,000
† Thomas Lynch	,,	—	,,	7,300	1 880
† H. P. McIntosh .	,,	—	,,	7.200	1.600
† Henry Phipps ..	,,	—	Fairport	7,300	1,880
† Leland S. Degraff	,,	—	N. Tonawanda, N.Y.	7,500	1,880
† Geo. F. Baker ..	,,	—	Duluth	7,300	1,880
a Wissahickon ..	,,	—	Erie	3,800	1,500
† Hemlock	,,	—	Fairport	4,800	1,500
† Wm. M. Mills ..	,,	—	N. Tonawanda, N.Y.	7,500	1,880
† Odanah	,,	—	Fairport	4,800	1,500
† Calumet	,,	—	,,	4,800	1,500
† Cyprus	,,	—	,,	4,800	1,500
a Ward Ames ..	,,	—	Duluth	6,700	1,800
† Salt Lake City	,,	—	Fairport	7,000	1,760
† Crete	,,	—	,,	5,500	1,600
† J. J. Sullivan ..	,,	—	,,	7,000	1,760
† Edwin N. Ohl ..	,,	—	,,	5,000	1,500
† Verona	,,	—	,,	5,500	1,600
† Arthur H. Hawgood	,,	—	,,	7,000	1,760
Reliance	,,	—	—	2,500	no eng.
Harvard	,,	—	—	90	old eng.
† Wm. A. Hawgood	,,	—	Fairport	7,000	1,760
† Adriatic	,,	—	,,	4,800	1,500
a H. P. Bope ..	,,	—	Duluth	6,700	1,800
† Elba	,,	—	Fairport	400	1,500
† Chas.W.Kotcher	,,	—	Duluth	4,800	1,500
† Caldera	,,	—	,,	6,300	1,600
† No names, 2 vessels	,,	—	—	5,500ea	1,600ea

By Bath Iron Works, Bath, Maine.

t Camden	Steel	—	Bath	2,153	4,000

By H. D. Bendiason Shipbuilding Co., Eureka, Cal.

Flaurence Ward	—	Auxiliary Steam Schooner	New York	450	—
Yellowstone ..	—	Steam Schooner	S. Francisco	750	—
Tabor	—	,,	,,	650	—

By William A. Boole & Son, Oakland, Cal.

† Sibyl Marston ..	Wood		San Francisco	1,086	700
Clam Shell Dredger ..	,,	—	,,	—	—

By F. S. Bowker & Son, Phippsburg, Maine.

Antoinett ..	Wood	— 3 master	Portland, Me.	300	—
Horace M. Bickford	,,	—	Boston, Mass.	503	—

By Buffalo Dry Dock Co., Buffalo.

† Favorite	—	Steam	Duluth	1,223	—
a Wissahickon ..	—	,,	Erie	4,062	—
Reliance	—	Wrkg. Bge.	Duluth	1,738	—
c Harvard	—	Tug	,,	85	600

By The Burlee Dry Dock Co., Port Richmond, N.Y.

**Jamestown ..	Steel	Ferry boat	New York	983net	1,200
†¶Standard II. ..	,,	Tug	,,	270 ,,	950
* Penna, 33.. ..	,,	,,	,,	48 ,,	250

By Chicago Shipbuilding Co., South Chicago, Ill.

† Thomas Lynch	Steel	—	Duluth	7,053	1,800
† Salt Lake City	,,	—	Fairport	6,530	1,600
† Wm. A. Hawgood	,,	—	,,	6 530	1,600
† Wm. B. Kerr ..	,,	—	Tonawanda	7,730	1,800

* Compound. † Triple. ** Triple Compound. *a* Quadruple. *t* Turbine. *c* Single Cylinder.

By The Wm. Cramp & Sons' Ship and Engine Building Co., Philadelphia.

Name of Vessel	Built of	Class.	Owners.	G T. Regis.	I.H P
† Saratoga	Steel	Steam	New York	6,391	10,841
† Massachusetts ..	,,	,,	,,	4,029	7,700
† Bunker Hill ..	,,	,,	,,	4,029	7,700
t† Old Colony ..	,,	,,	,,	4,029	7,700
* Commonwealth .	,,	,,	,,	6,350	11,000

By Crawford & Reed, Tacoma, Wash.

Scow Mead, No. 2	—	Hoppers	Tac Wn.	500ab	—
* Olympia	—	Tug	—	50ab	—

By J. H. Dialogue & Son, Camden, New Jersey.

† Hercules and Goliah	Steel	Tugs Rig Schooners	San Francisco	420ea	900ea
† Ontario and Western ..	Steel	Tugs	New York	420ea	900ea

By W. & A. Fletcher Co., North River Iron Works, Hoboken, N.Y.

t Yale	Steel	2 masts	Bath, Me	—	10,000
t Harvard	,,	—	,,	—	10,000
b Princeton ..	,,	—	New York	—	4,500
* Uncas	,,	—	,,	—	600
b Perth Amboy ..	Wood	—	,,	—	600
b Knickerbock ..	Steel	—	,,	—	2,600

By The Fore River Ship Building Co., Quincy, Mass.

Viper..	—	U.S. Submarine	—	170dis.	250 B.H.P.
Tarantula ..	—	,,	—	170 ,,	250 ,,
Everett, Malden and Melrose	—	Colliers	Boston	3750ea	2,700ea
Salem and Birmingham ..	—	U.S. Scout Cruisers	—	3750dis ea	16,000 B.H.P. ea
Altamaha ..	—	Freighter	Brunswick, Georgia	2,667	1.200
New England ..	—	Lighter	New London, Conn.	417	400
Transfer Tug, No. 21		Tug	,,	425	—

By The Gas Engine Power & C. L. Seabury Co. Consolidated, Moris Heights, N.Y.

**Lyndonia ..	Steel	Steam Yacht Schooner rig	N.Y.	261	1,000
† Halcyon	,,	,,	Detroit, Mich.	161	400
Haida	—	Aux wood schooner	—	approx. 120 gros	200 gas engine

By Gildersleeves Shipyard, Gildersleeve, Conn.

2 Barges	Wood	—	Hartford, Connecticut	900ea	—
Dan	,,	Lighter	,,	700	—
R. J. Wright, No. 10	,,	Car Float	New York	800	—
Blue Line ..	,,	Coal Barge	,,	1 250	—
4 Barges		—	Hartford, Connecticut	650ea	—

By The Great Lakes Engineering Co., Detroit, Mich.

† Wm. B. Davock	Steel	—	Fairport	4.446	1,300
† Thomas F. Cole .	,,	—	Duluth	7,268	1,800
† Wilpen	,,	—	Fairport	7,612	1,800
† D. O. Mills ..	,,	—	,,	6,598	1,800
† Milinokett ..	,,	—	Duluth	6,215	1 650
† John J. Boland	,,	—	Buffalo	6,035	1,650
† Jacob J. Kopp	,,	—	,,	6,035	1,650
† Josiah S. Munro	,,	—	N. Tonawanda	6,971	1,650
a Rochester ..		—	Duluth	4.571	2,000
a Bennington ..		—	Ogdensburg	2 300ab	1,400

* Compound. ** Triple Compound. † Triple. *a* Quadruple. *b* Beam Engine. *t*† Turbine Triple. *t* Turbine.

By The Greenport Basin & Construction Co., Greenport.

Name of Vessel	Built of	Class.	Owners	G.T. Regis.	I.H.P.
p M. P. McDonagh	Wood	Steam	Greenport, New York	—	75

By Hall Bros., Marine, Railway & Shipbuilding Co., Winslow, Wash.

* Shua-Yak ..	—	Schooner — 3 masts	San Francisco, California	900	800

By Harlan & Hollingsworth Co., Wilmington, Del.

† Delaware	Steel	Freight Steamer	New York	1,908	1,250
**Bay Ridge, Gowanus & Nassau	,,	Ferry-boats	,,	1,396ea	2,000ea
† St. Helens and Olson & Mahony	,,	Lumber Steamers	San Francisco Cal.	1,497ea	1,100ea
Central R.R. Co. of N.J. Car Floats 4, 5 and 6 ..	,,	Floats	—	850ea	—

By Kelly Spear & Co., Bath, Maine.

Erie R.R. Co., No. 1	Wood	Car Float	New York	—	—
No. 6..	—	Covered Lighter	,,	406 *n*	—
,, 7..	—	,,	,,	409 ,,	—
	—	Dredger	Fall River	300 ,,	—
,, 8..	—	Covered Lighter	New York	410 ,,	—
,, 9..	—	,,	,,	404 ,,	—
,, 10	—	,,	,,	403 ,,	—
Sag Tow Co. No. 2	—	Barge	Bath	600 ,,	—
Smyrna	—	,,	New York	720 ,,	—
No. 1	—	Covered Lighter	,,	410 ,,	—
Cadosia	—	Barge	,,	732 ,,	—
Sidney	—	,,	,,	725	—
Sag Towing Co., No. 4	—	,,	Bath	610 ,,	—

By The Lindstrim Shipbuilding Co., Grays Harbor, Aberdeen, Wash.

* J. Marhoffer ..	Wood	Steam Schooner	San Francisco	739	620
* Berkeley	,,	,,	,,	630	600
* Ber and Grays Harbour ..	,,	,,	,,	745ea	640ea
* Claremont ..	,,	,,	,,	830	720

By Maryland Steel Co., Sparrows Point, M.D.

**Rucon	Steel	Sea-going Suction Dredge	Colon	2,500	2,000
**Culebra	,,	,,	La Boca	2,500	2,000
† Florida	,,	Pass. Steamer	Baltimore	2,185	2,600
**Maryland	,,	,,	Philadelphia	1,369	1,900
N.Y.C. & H.R.R. No. 21	,,	Car Float	New York	900	—
N.Y.C. & H.R.R. No. 22	,,	,,	,,	900	—

By Moran Brothers Co., Seattle, Wash.

† Seward ..	Steel	Schooner Rig	Port Townsend	2,499 *n*	1,300
* Tyee Junior ..	,,	No Sails	Seattle, W.	156 ,,	350
† Chicago	,,	Schooner Rig	—	143 .	600
† Stanley Dollar..	.	..	San Francisco	1,730 ,,	850
† Ajax	,,	No Sails	,,	255 ,,	600
† Corrinne	—	—	—	—	—

p Petrol. * Compound. † Triple. ** Triple Compound.
n Including Erections.

By Neafie & Levy, Ship and Engine Building Co., Penn Works, Philadelphia.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
† Machizonne ..	Steel	Single Screw	Portland Maine	425	600
† Boothbay	..	..	Boston	395	600
† General Hubbard	..	..	New York	413	900
† Gwalia	..	..	Boston	415	900
* Lizzie D.	,,	..	Philadelphia	122	300
* Belhaven	,,	,,	New York	96	250
* Bern	,,	,,	Philadelphia	224	700
c Adriatic	,,	,,	..	120	300

By Newport News Shipbuilding and Dry Dock Co., Newport News, Va.

Six Dump Barges	Steel	—	—	750dis ea	
† Three Car Floats	,,	—	—	1,200 ,,	—
c Two Car Floats	,,	—	—	885 ,,	—
† Brazos	,,	Frt. & Pass. Steam	New York	6,223	6,500
† Sun	,,	Oil Tank Steam	Philadelphia	4836	2,000
Dredge Hull ..	,,	—	—	—	—
† Nann Smith ..	,,	Lumber Steamer	Saint Paul	2,100	1,350
† Geo. W. Fenwick	..	..	New York	2,100	1,350

By New York Shipbuilding Co., Camden, N.J.

† Columbia	Steel	Bay Steamer	Baltimore	2,582 *n*	3,000
† Governor	,,	—	New York	5,220 ,,	5,000
* 5 Vessels	Steel	Light Vessels	,,	488ea ,,	360ea
Princeton ..	Steel	River Steamer	—	4,400 ,,	Hull only
3 Barges	Oil	—	New York	374ea ,,	

By Percy & Small, Bath, Maine.

Fannie Palmer .	Wood	5-mast Sch.	Boston	2,233 *n*	—
Governor Brooks	Wood	5 masts	Bath	2,628 ,,	—

By Pusey & Jones, Co., Wilmington, Delaware.

Major Albert G. Forse	Steel	—	America	150	300
Captain I. W. Morrison ..	,,	—	,,	150	300
Captain Chas. W. Rowell	,,	—	,,	150	300
Androscoggin ..	Wood	—	,,	1,006	1,800
Pamlico	Steel	—	,,	474	600
———	,,	—	Mexico	65	300
Launch	,,	—	South America	3	12
2 Barges	,,	—	Mexico	108ea	—

By Wm. K. Osborn, Croton-on-Hudson, N.Y.

* Frolic	Wood	—	New York	49 *n*	75

By Jas. Rees & Sons, Co., Pittsburg, Pa.

Shin Clare Ramos	Stern Wheel		Frontua	150	125

By Arthur D. Story, Essex, Mass.

Edith Silvera ..	Wood	Schooner	Boston	84	—
May F. Patterson	,,	,,	Greenport L.J.	57	—
Julia Davis ..	,,	,,	,,	57	—
Schooner	,,	,,	—	80	—
Janessa	,,	,,	Boston	138	—

By The Superior Shipbuilding Co., West Superior, Wisconsin.

† Theldon Parke..	Steel	—	Fairport	6,611 *n*	1,600
† Geo. F. Baker ..	,,	—	Duluth	7,395 ,,	1,800
a Ward Ames ..	,,		,,	5,750 ,,	1,800
a H. O. Bofer ..	,,		,,	5,750 ,,	1,800

LIST OF VESSELS ENGINED IN 1907.

By United Engineering Works, San Francisco, Cal.

Name of Vessel	Builders	I.H.P.	Press. lbs.
† F. S. Zoop ..	Zoop Lumber Co.	600	220
* Str. Tahoe ..	A. S. Tillette	425	160
* Str. Bowdoin ..	Wm. Turner	425	160

a Quadruple. *c* Single Cylinder. * Compound. † Triple.
n Including Erections.

CANADIAN.

By The Collingwood Shipbuilding Co., Ltd., Collingwood, Ontario.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
† Helena	Steel	Sea-going Tug	Halifax	262	600
3 Hopper Barges	,,	—	,,	550 cu. yds cap.	
† Collingwood ..	,,	3 pole masts	Collingwood	4,314	1,600
Hopper Barge ..	,,	—	—	300 cu. yds. cap.	
† Agawa	,,	Tow Barge	Sault Ste. Marie	3,759	1,500

By B. M. Cochran, Fox River, N.S.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
Kenneth C ..	—	Tern Schooner	Parrsboro N.S.	470	15

By G. A. Cox, Shelbourne, N.S.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
Roseway	—	Tern Schooner	Shettum	242	—

By A. W. Hendry & Son, Liverpool (Queen's Co.), N. S.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
Annie	—	Tern Schooner	Liverpool	230	—
Schooner	—	—	Liverpool	260	—

By Hugh Gillespie & Co., Parrsboro, N.S.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
Kenneth C ..	Wood	Tern Schooner	Parrsboro	551	—

By Joseph McGill, Shelburne, N.S.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
Portia	Wood	Schooner	St. John's N. F. Land	65 n	—
Enterprise ..	Wood	Steam	Georgetown P.E. Island	—	—
Samson (tug) ..	Wood	Steam	Bridgewater Nova Scotia		
Francis	Wood	Schooner	Shelbourne	72 n	—

By Polson Iron Works, Toronto.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
‡ Dump Scows, Nos. 1 and 2 ..	Steel	—	Ottawa	400ea	15ea
† Morning Star ..	Composite		Kingston	35	375
* Loretta	,,	—	Ottawa	60	130
* Bessie Butler ..	,,	—	Peterboro	60	130
* Roberval ..	Steel	—	Toronto	343	300
* Charles Lyon ..	,,	—	,,	1,600	1,600

By J. H. Wagner, Mahone Bay, N.S.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
* Scotia	Wood & Iron	Schooner	Halifax	403 n	162
Dredger	Wood	—	,,	87 ,,	—
Hopper Scow ..	,,	—		45 ,,	—

JAPANESE.

By Hakodate Dock Co., Ltd., Hakodate.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
* Nanaye Maru ..	Wood	Steam Tug	Hakodate	54 n	110
‡ Otsu Maru	,,	Steam Launch	..	18 ,,	43
/ Koyaye	..	..	..	6 ..	18

By Ishikawajima Shipbuilding and Engineering Co., Ltd., Tokyo.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
† Yamamitsu Maru	Steel	Schooner	Tokyo	916 n	636
† Tebisu Maru ..	,,	..	,,	200 ..	44N.H.P.
† Benten Maru ..	,,	..		200 ,,	44N.H.P.
Kobo Maru ..	Wood	..		165 ,,	—
3 Steam launches ..		—		15ea ,,	55ea
3 Steel Hopper Barges ..	Steel	—	—	—	—

By Mitsu Bishi Dockyard and Engine Works, Nagasaki.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I H P
t Tenyo Maru (No. 190)	Steel		Tokyo	13,500 n	6,850
t Chiyo-Maru (No. 191)				13,500	16,850
† Kamo-Maru (No. 195)				8,770	7,000

* Compound. † Triple. ‡ High Pressure. / Compound Non-Conducting. t Turbine. n Including Erection

By Kawasaki Dockyard Co., Ltd., Kobe.

Name of Vessel	Built of	Class.	Owners	G T Regis	I H P
† Nan Yan Maru ..	Steel	—	Tokyo	3,588 n	2,800
† Siang-Yang Maru	..	—		3,588	2,800
† Houzan Maru .	..	Schooner	Osaka	2,509 ..	2,750
† Kagi Maru .				2,509	2,750
War Vessels					
† Yodo (Imp. Japanese Despatch Boat) ..	Steel				6,500
† Chu-Chien (Imp. Chinese Gunboat)	..	—		—	1,350
† Chu-Yii do. ..	.	—		—	1,350
† Chu-Kwang, do.	..	—		—	1,350
† Kiang Heng, do.	..	—		—	950
† Kiang Li do. ..	,,	—	-	—	950
† Kiang Cheng do.	..	—		—	950
† Hu Shun (Imp. Chinese Torpedo Boat) ..	..	-		—	1,200
† Hu Yen, do. ..	,,	—	—	—	1,200

By Onos Shipbuilding Yard, Osaka.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Kochi Maru ..	Steel	Sloop Steam, 2 dks.	Kochi	359 n	350
† No. 2 Ono Maru .	Wood	Schooner Steam, 2 dks.	Osaka	621	400
† No. 11 Uwajima	Steel	Stoop Steam, 2 dks.	Uwajima	495 ..	400
* 1 Tug	,,	Steam	Osaka	44 .	80
* 1 Tug	Wood	Steam	..	32 ,	60

By Osaka Iron Works, Osaka.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Miyazaki Maru	Steel	—	Osaka	762	571
† Oita Maru ..	..	—		762	582
† Beppu Maru ..	,,	—	.	762	607
† Matsuye-Maru .	..	—	..	762	563
† Tora Maru (Oil Tank Steamer) ..		—	.	-	-
* Fuji Maru ..	,,	—	Ujina	82	—
† No. 2 Hogei Maru (whaler) ..	..	-	Tokyo	-	-
† Okinoshima Maru	..	-	Moji	-	-
† Rokko Maru (whaler) ..	,,	—	Kobe	—	—
Double 15 ton Rock Cutter ..	..	-	-	-	-
300-ton Bucket Dredger ..	..	-	-	—	—
† Bujun Maru ..	..	—	Osaka	-	—

CHINESE.

By The New Engineering and Shipbuilding Works, Ltd (Arnhold Karberg & Co., Gen. Managers), Shanghai.

Name of Vessel	Built of	Class.	Owners	G T Regis.	I.H P
* Kai-Hai	Steel	Screw	Newchwang	160 n	275
* Sunbeam	—	,,	Shanghai	20 ,	75
* Launch	—	,,	,,	30 ..	90
Firefloat	—	,,	..	30 ,,	hull only
4 Lighters ..	Steel	,,	—	200 ..	—
2 Hopper Barges	..	,,	—	352 ,,	—
4 Pontoons ..	.	,,	—	457	—

By Shanghai Dock and Engineering Co., Ltd., Shanghai.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† Kian	Steel	Steam	—	1,195 n	834
Lighters Nos. 1 and 2	,,	Sail	—	208ea.	—
Pontoon	,,	—	—	217 .	—
* Minnie	Teak-wood	Steam	—	20	30
Pontoon	Wood		—	55 ,	—
Hopper Barge No. 1	Steel	Sail		176	—
Hopper Barges, Nos. 2, 3 & 4 ..	.	.	—	183ea	—
* Tow Boats Nos. 1, 2 and 3	..	Steam	—	80ea,	200ea
* Water Boat ..		—	—	90 ,	150
Barge No. 5 ..	.	Sail	—	36	—
Barge No. 6 ..	.	..	—	39 .	—

* Compound. † Triple. n Including Erection.

INDIAN.

By Burn & Co., Ltd., Howrah, Bengal.

Name of Vessel	Built of	Class.	Owners.	G.T Regis	I H.P.
3 Barges	—	Sail	Rangoon	1,296	—
2 ,, ...	—	,,	,,	576	—
2 ,, ...	—	,,	,,	70	—
1 ,, ...	—	,,	,,	170	—
3 ,, ...	—	,,	Calcutta	180	—
2 ,, ...	—	,,	,,	118	—
2 ,, ...	—	,,	Madras	80	—
1 ,, ...	—	,,	,,	100	—
2 ,, ...	—	,,	Calcutta	864	—
17 ,, ...	—	,,	,,	850	—
1 ,, ...	—	,,	,,	100	—
4 Pontoons ..	—	,,	,,	80	—
1 ,, ..	—	,,	,,	104	—
1 Dredger.. ..	—	Steam	,,	1,000	2,400
1 Steam Barge ..	—	,,	Madras	320	250
1 Launch	—	,,	Calcutta	35	120
1 ,, ...	—	,,	,,	35	120
1 ,, ...	—	,,	,,	60	200
3 ,, ...	—	,,	,,	60	150
4 ,, ...	—	,,	,,	300	2,000

WORK COMPLETED DURING THE YEAR.

ENGLISH.

Sir W. G. Armstrong, Whitworth & Co., Ltd., Elswick Works, Newcastle-on-Tyne.- Particulars of various classes of vessels built at Walker and Elswick shipyards from 1852 to 1907 :

	No.	Gross Tonnage	I H.P.
War Vessels	116	288,847	715,155
Passenger and Cargo Steamers..	420	649,563	385,951
Petroleum Steamers	88	248,781	124,636
Ice Breakers, Dredgers, etc. ..	83	51,038	39,220
Paddle Steamers	93	24,840	29,556
	800	1,263,069	1,294,518

	Tonnage	I H.P.
Totals for last seven years	349,580	363,040
Maximum in one year, *viz*, 1902 ..	52,039	48,150
Average per annum	49,940	51,863

The Northumberland Shipbuilding Co., Ltd., Howden-on-Tyne.—Included in the vessels launched are five of the Northumberland Shipbuilding Company's celebrated type of 7300 ton deadweight steamers, and it is a noteworthy fact that the company have now launched 46 of these vessels, thus constituting a record for vessels of the same size and type built to one model It will be observed that the Northumberland Shipbuilding Company again show a large output, which, taking into consideration the size of their premises, is very satisfactory, and is a further tribute to the management in return for the energy displayed in keeping the establishment so well employed in spite of the scarcity of work and the apparent distress in other parts of the North-East district It might here be mentioned that the number of vessels the company are capable of turning out each year is somewhat restricted, owing to their inability to extend the works on account of being hemmed in on either side.

John Readhead & Sons, West Docks, South Shields. Their graving dock and repairing departments have been fully occupied during the year.

Joseph L. Thompson & Sons, Limited, Sunderland. This year is their record output, the previous highest having been in 1905, when they launched 47,330 actual Board of Trade gross register tons The following is a record of their output since the establishment of the firm

Years		Material	Ships	B of T gross tonnage	Average per ship
1846-1870 (25 years)	..	Wood	103	38,522	374
1871-1880 (10 years)	..	Iron and steel	58	79,110	1364
1881-1890 (10 years)	..	Do	113	234,271	2073
1891-1900 (10 years)	..	Do.	113	338,033	2991
1901-1907 (7 years)	..	Do.	77	288,773	3750

Sir Raylton Dixon & Co., Ltd., Middlesbrough on Tees. In addition to building the vessels launched, a large amount of repairing work has been done Of the 28,380 tons launched, nearly 23,000 tons are of the Patent Cantilever type

S. P. Austin & Son, Limited, Wear Dockyard, Sunderland.—In addition to the new tonnage built, the repairing docks and quays of this company have been kept well occupied during the year, the repairing of steamers' hulls and machinery being a special feature of the company's business, and the tonnage dealt with in the docks during the year has exceeded 250,000 tons.

Irvine's Ship-building and Dry Dock Co., Ltd., West Hartlepool.—Of the vessels launched, the S.S "Richmond," "Abonema," and "Palma," are of the shelter-deck type, fully equipped with electric light and accommodation for a few passengers.

Goole Shipbuilding and Repairing Co., Limited, Goole In addition to vessels launched, they have done a large amount of repair work to engines and hulls of steamers.

J. Scarr, Beverley and Howden.—Repaired 30 vessels.

Gill & Son, Bridge Yard, Rochester.—Admiralty, 32 ft. cutter, wood; Admiralty, 32 ft. cutter wood; Admiralty, 27 ft. whaler, wood; Admiralty, 14½ ft. Balsa, wood; "François," wood cutter, Rochester; *m* "Wanderer," wood cutter, Ramsgate, 6 tons, 6 B H.P.; *m* "Dolcemono," wood, London, 6 B.H P.; "Daisie," wood ketch, London; "Daisie" launch, wood, London, 25 I H P.; "George and Eliza" wood sprit, Rochester; War Office, 25 ft cutter, wood; War Office, 22 ft. gig, wood

Yarrow & Co., Ltd., Poplar, London, E.—British: 3 Yarrow water-tube boilers for H M Royal Yacht "Alexandra." Foreign: 1 Yarrow water-tube boiler for fire float. British: 4 Yarrow water-tube boilers for H M. first-class torpedo boats Nos. 17 and 18. Foreign: 1 Yarrow water-tube boiler for Spanish torpedo boat "Azor." Foreign: 1 Yarrow water-tube boiler for Spanish torpedo boat "Orion." Foreign: 2 Yarrow water-tube boilers for Spanish gunboat "Marqués de Molins."

J. & W. B. Harvey, Littlehampton.—Motor boats and other boats.

Simpson, Strikland & Co., Ltd., Dartmouth, Devon.—Thirty-two yachts, launches, etc, of a total gross tonnage of 266, and a total I.H.P. of 1545, also machinery only of 947 I H P.

R. R. Stevens, Ltd., West Quay, Southampton.—A number of small boats about 15 tons total.

John I. Thornycroft & Co., Ltd., Southampton. In addition to vessels launched, a large amount of repair work has been executed to liners, yachts, etc., at this Port, the principal jobs being cutting away and preparing the "Suevic" for the new bow

J. Samuel White & Co., Ltd., East Cowes, Isle of Wight In addition to vessels launched, the s y. "Ivy,", 1100 tons, the official yacht of the High Commissioners of Southern Nigeria, has undergone reboilering and complete overhaul and refit, including extensive alterations to accommodation and complete renewal of electric light installation.

By Mordey, Carney & Co., Ltd., Newport, Mon.—Screw tug 230 H.P.

Engines, etc.

Blair & Co., Ltd., Stockton-on-Tees.—In addition to vessels engined, eleven new boilers have been built for trawlers and donkey boiler purposes having an aggregate H P of 3,600. Total I H P for the year 53,400.

Central Marine Engine Works, West Hartlepool.—In the boiler department, besides the twenty-eight boilers built for new ships, seventeen other boilers have been built during the year. Amongst these are some for the British Admiralty, for the North-Eastern Railway, and for renewals in other vessels. A special type of high grade donkey boiler, instead of the usual type, has been a feature of the work produced. In addition to the usual run of manufacture, a large weight of large size castings has been made for foreign orders The drop forging plant at these Works has been actively employed, and additional machines have been laid down to meet the ever-increasing demand

Cox & Co., Falmouth. Have supplied new boilers and machinery to various craft, besides sundry other work and heavy repairs to hulls and machinery of vessels calling at the port

R. & W. Hawthorn, Leslie & Co., Ltd., Newcastle-on-Tyne. In addition to the vessels engined, Messrs Hawthorn, Leslie have supplied the boilers for H M S "Afridi" (14,250 I.H P.), and carried out a complete overhaul to the machinery and boilers of the Portuguese Cruiser "Don Carlos" (12,000 I H P) In regard to locomotive work, the output of Messrs. Hawthorn, Leslie's Forth Banks Works has been very largely increased during the past twelve months.

MacColl & Pollock, Ltd., Sunderland. The horse-power of the boilers, constructed apart from those supplied along with the vessels engined, amount to 4,430 I H P

North-Eastern Marine Engineering Co., Ltd., Wallsend and Sunderland.—Vessels re-boilered

Dalton	Newcastle	800
Euphrates	Hull	210
José Gallart	Barcelona	2250
Miguel Gallart	Barcelona	300
Nina	London	900
St Lawrence	Hull	200
t s. "Tritao"	Oporto	500

Total, including vessels engined .. 126,630 I H P.

Of the above 126,630 I H P., 70,300 was constructed at Wallsend Works and 56,330 at Sunderland Works The Northumberland Forge, which belongs to this Company, has, during the year, turned out 3,000 tons of marine engine forgings The output of marine engine specialities, such as feed-heaters, evaporators pumps, etc, has also been a very large one. Summary of Output I H P 1903, 92,903 1904, 105,385. 1905, 104,095: 1906, 120,854. 1907, 126,630. Total, 549,867 I.H.P. Average for 5 years 109,973 I.H.P

John Readhead & Sons, West Docks, South Shields— In addition to the hulls of the vessels launched, they have also built the boilers and machinery for same

Richardsons, Westgarth & Co., Ltd. In addition to the vessels engined, a large amount of miscellaneous work has been completed, including steam turbines, "Contraflo" condensing plants, "Cockerill" type gas engines, blowing engines, marine boilers and "Nesdrum" water tube boilers, Talbot furnaces, Mixers and other steel works plant.

The Wallsend Slipway and Engineering Co., Wallsend-on-Tyne. In addition to vessels engined, they have fitted twenty-three vessels with new boilers only, representing a total I.H.P of 10,580, and also four vessels fitted with oil burning installations.

The Edwards' Patent Air Pump has been fitted during the year 1907 to more than 400 Steamers, and this satisfactory total has been reached, notwithstanding that during the last few months there has been a considerable reduction in the number of orders for new tonnage. The fact that the only valves used in the Edwards' pump are readily accessible for examination and renewal renders it very reliable, and this freedom from breakdowns, together with the reduced cost of maintenance, make the Edwards' Pump a great favourite with all engineers who have had experience with it Many of the leading marine engine-builders have now standardised the Edwards' air pump and fit it to all the engines which they build We may also mention that the Edwards' pump has been fitted to over 400 electrical installations and that the total number of pumps built to date exceeds 7400 This number includes many pumps which have been fitted for use in connection with Parsons, Curtis and De Laval turbines

Toope's Asbestos Covering Co., Ltd., inform us that during the past financial year, they have practically doubled their output both in asbestos mattresses and sectional removable coverings.

United States Metallic Packing Co., Ltd., Soho Works, Bradford, have fitted their Metallic Packings to the following vessels.—H M S's Glory, Goliath, Industry, Pandora, Quail, Shannon, Minotaur, Defence, Agamemnon, Lord Nelson. New Steamer, Aberdeen White Star Line, Aberdeen: ss.'s Echunga, Narragansett, California, Rovenska New Steamers, Austrian Lloyd's Arsenal, ss Haverstoe: New Ship, Brazilian Government, ss.'s Oberon, Makama, Grange, Thames, Active, Rissa, Dotterel, Ivernia, Pannonia, Skirmisher, Slavonia, Mauretania, Lusitania, Malte, Ceylon, Majestic, Charlton Hall, Gwalior, Frances Duncan, Bahadur, Begum, Gando, Fulani, Prashu, Salaga, Sierra Leone, City of Delhi, City of London, City of Paris, Crewe Hall, Walton Hall st Gallant, sy Nerissa New Tug Boat, Furness Railway Co. Barrow-in-Furness st Resolute. ss.'s Chipana, President Grant, President Lincoln, Alice, Edith, Civilian, Craftsman, Huntsman, Politician, Senator, Hesperides, Homerius, Honorius. Survey Vessel, Investigator, Indian Government, New Steamers, India General Navigation Co Ltd New Steamers, Italia Steam Navigation Co, ss.'s Spheroid, Princess Dagmar. New Steamer, Lancashire and Yorkshire and L & N W Joint Railways. ss.'s Douglas, Anglo-Colombian, Anglo Mexican, Verdi New Steamers, F Leyland & Co (American Line), Liverpool tss.'s Regina Italia, Principe de Piemonte, Regina d'Italia, Tomaso-di-Savoia; New Steamers Lloyd's Sabauda ss.'s Ceara, Cubatao, Para, Rio de Janeiro, San Paulo, Ibiapaba; New Steamers Lloyd's Braziliero, New Steamer, W Lund & Sons (Blue Anchor Line); ss.'s Manchester Importer, Chieftain Pioneer New Dredger, Mersey Docks and Harbour Board; sy. Maid of Honour, New Steamer, H. E Moss & Co, Liverpool; ss.'s Dinorwic, Opawa, Chikuzen Maru, Chikugo Maru, City of Liverpool, sp Dredger Pearson, Dredger David Campista, ps. Brighton, ss.'s Norse Prince, Royal Prince, Coniston, Dunholme, Laura, Rosebank, Waverley, Winifred, St. Michael, Avon, Asturias, Oruba, Clintonia, Euphorbia, Carpenby, Clearpool, Coleby, Hawnby, Haxby, Heronspool, Hurworth, Ingleby, Kirkby, Moorby, Oakby, Selby, Stagpool, Thirlby, Trunkby, Wandby, Yearby, Aquilla, New Steamer, Savage and Co., G A, Liverpool; Elevator Leitrim: ss.'s Arawa, Moyle sy. Lady Blanche; ss.'s Kinta, Perak, Tabaristan, Lady Lewis, Blackwater; Dredger, Lord Desborough. New Steamer, Tyne-Tees Shipping Co., Newcastle-on-Tyne, ss. Howth Head; New Steamer, Veloce & Co., Genoa; ss.'s Chiswick, Regulus, Retriever, Hindoo.

SCOTCH.

John Robertson, St. Monans.—Three vessels, the "Pursuit," "Unity," and "Olive Leaf," for Kirkaldy owners, fitted with compound engines

Engines, &c.

Hawthorns & Co., Limited, Leith.—While they have done very little building, have been pretty well employed throughout the year with other work generally They constructed and engined two steel drifters, "Cavalier" and "Chimaera," of 350 I H P each, to the order of Mr. Thomas Devlin, junr, fish salesman, Newhaven. They have also supplied the following wooden drifters with machinery:—Fertility, Endeavour, Pisces, 300 I H P. each: Speedwell, Laurelia, Morning Star, Azarael, Evening Star, Hawthorn, Laurel, Breadwinner, 350 I H P each

McKie & Baxter, Govan, Glasgow.—Marine machinery totalling 9710 I H P

Ross & Duncan, Whitefield Works, Govan.—In addition to boilers for the vessels engined, 26 boilers have been constructed of 7125 horse-power.

David Rowan & Co., Glasgow. 46 marine boilers for shipment, amounting to 10,500 I.H.P. aggregate.

W. Simons & Co., Ltd., Renfrew.—Have supplied a powerful electrical winch for the Clyde Trust's new slip-way, and large orders of engines and dredging machinery for home and foreign ports

IRISH.

Harland & Wolff, Ltd., Belfast

aPresident Lincoln (No 353)	Increase of tonnage over that previously returned when vessel was launched, also increase of horse-power.	Hamburg	1294	1123
aPresident Grant (No 354)	Do	Do	1309	1207

BELGIUM.

Aug. Hamman, Ostend.—Vessels repaired including most fishing vessels and one pilot vessel of the Belgian State Marine, their main business being the repair of vessels and boats and yachts.

DUTCH.

The Arnhem Co., Arnhem. Including the boilers for the vessels engined, they totally built 20 marine boilers with 16,200 sq ft, heat surf aggregating 5300 I H P

The Wilton's Engineering and Slipway Co., Rotterdam. Six new boilers for old ships, with a total heating surface of 6850 sq ft

SWEDISH.

Bergsunds Mekaniska Verkstads Aktiebolag, Stockholm.

Name of Vessel	Built of	Class	Owners.	G T Regis	I H P
**Russ passenger steamer for Russian Danube navigation	Steel	Schooner	Odessa	1,052 n	1,400
**Fylgia, armoured cruiser for the Swedish Navy	Steel	..	Karlskrona	4,200 ,,	12 700

AMERICAN.

The American Car and Foundry Co.—Have not built any steam or sail vessel during the year; their work has been car floats, lighters, barques, etc., not registered

Jas. Davidson, West Bay City, Michigan—State that they have launched two very large dumping scows, each to have a capacity of 500 cubic yards. Their dry dock was constantly employed dry-docking, repairing and rebuilding ships.

The Fore River Shipbuilding Company of Quincy, Mass.—Record for the year 1907 shows ten vessels launched or to be launched. Two of these are submarines and two are scout cruisers built for the United States Navy; four vessels will be used in the freight service and two smaller craft, a lighter and a tug, will be used in harbour work by the New England Steamship Company. Of the ships launched in 1907 the submarines Viper and Tarantula, the collier Everett and the lighter New England have been delivered and are now in service. It is expected that the collier Malden will be delivered and in service within a month.

The Gas Engine Power and C. L. Seabury Co. Consolidated, Moris Heights, N Y.—In addition to vessels launched approximately 250 gross tons in steam, naphtha and explosive launches up to 70 feet oa

Hall Bros. Marine Railway and Shipbuilding Co., Winslow, Washington—Have built in addition to vessel launched three barges for towing, of 700 tons net each, also two barges of 400 tons each

Manitowoc Dry Dock Co., Manitowoc, Wis—Francis Simmons, hydraulic dredger, 30 in. suction, new propulsion; two 750 cubic yards dump scows; 2000 ton stone lighter; 600 cubic yards dump scow

J. Bigelow, Canning, U.S.—Barkt Rescue, repaired and rigged into three-masted schooner, now loading for Havanna, Cuba.

CUBA.

Davis Dry Docks Co., Kingston, Ontario—Small boats, 20 to 100 feet long. Their principal business is stocking and general repairs in wood and iron, engine-builders, etc Dry Dock 185 ft, 36 ft

AUSTRALIAN.

Walkers' Ltd., Maryborough, Queensland, Australia.—No vessels launched or under construction during 1907, but a fair quantity of removal and repair work has been carried out.

STRAITS SETTLEMENTS.

Singapore Slipway and Engineering Co., Ltd., Singapore—

Four	Teak Wood	Cargo	Lighters	46′ 8″ × 13′ 0″ × 5′ 8″
Four	,,	,,	,,	56′ 0″ × 15′ 6″ × 6′ 9″
Two	,,	,,	,,	64′ 0″ × 17′ 6″ × 7′ 8″

JAPANESE.

The Yokohama Dock Co., Ltd., have not built any good-sized boat during this year, although they built a few steam launches and motor barges carrying oil in bulk. They are doing mostly repair work, and during this year have had pretty good amount of the same.

WORK ON HAND IN BRITISH YARDS.

ENGLISH.

Hepple & Co., Ltd., Wapping Street, South Shields.—Two steam tugs for foreign owners.

The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne At present the company's berths are all full, and the work in hand will keep them employed at any rate over the winter months

Wm. Harkess & Son, Ltd., Middlesbrough. The Elder Dempster & Co 's mail and passenger steamer Baro, 225 ft × 36 ft × 14 ft moulded

Thomas Dobson & Co., Hessle Haven.—About 900 tons.

Goole Shipbuilding and Repairing Co., Ltd. Approximate gross tonnage 2500

W. H. Warren, New Holland.—Sea-going steel tug for Wales and steam fishing vessel for Yarmouth.

H.M. Dockyard, Portsmouth.—Bellerophon completing and Goliath refitting.

H.M. Dockyard, Pembroke.—*t* Boadicea steel unarmoured cruiser, 3300 dis., 18,000 I H P.

H.M. Dockyard, Chatham—Building: H.M.S. Shannon, 1st-class cruiser, 14,600 tons displacement, 27,000 I.H.P., twin-screw, triple-expansion engines. At present running trials Submarines, 2 No. Grappler, paddle tug, about 700 tons displacement, 1250 I H P., compound diagonal surface condensing engine, speed about 12 knots. Rover, twin-screw tug, about 600 tons displacement. Barges, 2 No., 500 tons. A large amount of repair work is in hand, and the following vessels are being refitted, *viz.*: Blake, Vulcan, Snapper, Tyne, Sutlej, Seal, Diadem

H.M. Dockyard, Devonport.—†1st-class cruiser Minotaur, steel armoured, 19,000 natural draught, 27,000 forced draught

Beeching Bros., Ltd., Great Yarmouth.

*No. 115 ..	.. Wood	Steam	—	95	140
*No. 116 ..	.. ,,	Drifters	—	95	140

John Chambers, Lowestoft—About 900 tons, similar to the vessels launched.

Edwards & Co., Ltd., Millwall, E.—Two passenger steamers and one fire float

Forrestt & Co., Ltd., Wyvenhoe.

2 Steam Pinnaces	Wood	—	British	30	150
Steam Tug ..	Steel	—	Foreign	12	—
,, ..	,,	—	,,	90	—
4 Steam Tugs ..	Wood	—	,,	156	—

Gill & Son, Bridge Yard, Rochester—4 wooden motor boats of 12 B.H P., for London owners.

W. H. Orvis & Co., Ipswich.

Spritsail Barge, Ipswich. Not measured.
New barge ready for launching.
Now building a new horse barge
Repairs to S.Y Agatha. Sir W. Greene.
,, S.Y. Vida Roger Keirison, Esq.
,, 52 footer Britomart. W. P. Burton, Esq
And sundry repairs to other yachts, etc.

By H. Reynolds & Sons, Lowestoft.

*Wear & Osprey ..	—	—	Lowestoft	82ea.	ab. 210ea
*Fearless	—	—	,,	81	,,
*County of Nairn	—	—	Inverness	81	..
*Emblem	—	—	,,	84	,,
*Easter Morn ..	—	—	Buckie	80	,,
Spey Bay ..	—	—	,,	90	ab. 800
Kestrel & Ivan ..		—	Lowestoft	55ea	—

R. Cock & Sons, Quay, Appledore, R S O., Devon.—Steel three-mast schooner, 260 tons gross, and steel fishing drifter

J. & W. B. Harvey, Littlehampton.—Sailing ketch of 230 d w. to class A1, under special survey at Lloyd's.

Hartley Mead, East Cowes.—3 wooden vessels of 10 tons each, for British owners, and a motor boat, wood, 16 tons and 20 B.H.P.

Philip & Son, Ltd., Dartmouth.

*Single screw tug..	Wood	—	—	30	80
* ,, ..	,,	—		25	70
* ,, ..	Steel	-		55	140
Ketch yacht ..	Wood	—		75	—
Horse ferry boat	,,		—	15	
Several small boats and machinery				20	120

Geo. & Thos. Smith, Ltd., Rock Channel, Rye, Sussex.—Two sister vessels to those launched.

H. R. Stevens, Ltd., West Quay, Southampton—Motor yacht cutter of 15 tons.

Stow & Sons, Shoreham—Two vessels building

J. Samuel White & Co., Ltd., East Cowes, Isle of Wight.—*t*Nos. 25 to 28, 4 first-class torpedo boats, 26 knots, steel, 1320, British Admiralty, 16,000 I.H P. *t*Saracen, ocean-going destroyer, 33 knots, steel, 1000, British Admiralty, 16,000 I.H P

Nicholson & Sons, Glasson Docks, *via* Lancaster.—Well employed on ship repairs in dry dock.

* Compound. † Triple. *t* Turbine.

T. Summers & Sons, Liverpool.—A wooden launch for Liverpool owners of 15 tons and 20 h p.

By Mordey, Carney & Co., Ltd., Newport, Mon. Steel dumb hopper barge, 203 tons gross.

Engines, &c.

Baird Bros., North Shields – New work at present quiet, having only one order booked for a set of machinery for screw-tug Repair work only fair, no large overhaul repairs in hand

Crabtree & Co., Yarmouth 18 compound engines of 3100 I H P. collectively.

Hepple & Co., Ltd., South Shields —Two steam tugs and engines for foreign owners

Mac Coll & Pollock, Ltd., Sunderland – Six sets of triple-expansion engines of about 5000 I H P

Mumford & Co., Colchester.

		I H.P	Pres lbs
‡‡50 ft Admiralty Steam Pinnaces	Various	1280	185
‡‡60 ft. ditto.	Forrestt & Co , Ltd , Wyvenhoe	250	185
‡‡Various Launches ..	Various	400	120

W. Sisson & Co., Gloucester.

* Majestic	E. Cawston, Reading	60	175
* Richmond Launch ..	Salter Bros., Oxford	100	165

The Vauxhall & West Hydraulic Engineering Co., Ltd.

‡‡	Edwards & Co	440	130
‡‡	Edwards & Co	300	120
‡‡Tug	Cook, Welton & Gemmell	460	130
‡‡3 Drifters	Charlton & Doughty, Ltd	648	140
f Launch..	Forrestt	45	135
‡‡ ,, ...	Forrestt	375	150
‡‡ 4 Launches	Forrestt	500	150
	Total	2768	

SCOTCH.

Alley & McLellan, Polmadie, Glasgow – Two sailing barges of 100 gross tons each for India, keel laid and frames being erected. One twin-screw tug of 80 gross tons and 200 I H P., for service at Rangoon, frames being set

Geo. Brown & Co., Greenock About 650 tons.

W. Chalmers & Co., Rutherglen —A 70 ft tug for Russian owners, with specially strengthened bow to resist ice

D. M. Cumming, Black Hill Dock, Glasgow Barge for foreign owners of 77 tons

Ferguson Brothers, Port Glasgow – Four vessels, 1,700 tons and 2,500 I H P.

Fleming & Ferguson, Ltd., Paisley Three vessels, 2,500 tons total

J. & J. Hay, Ltd., Kirkintilloch, Glasgow —Coasting steamer, steel, of 90 tons, with compound engines, for Glasgow owners

Peter MacGregor & Sons, Kirkintilloch —Four tugs and one lighter

Scott & Sons, Bowling, Glasgow.—About 870 tons

John Cran & Co., Leith – Two steel screw tugs of 168 tons each, with compound engines of 780 I H P each

Mackay Brothers, Alloa –Three steam drifters

John Robertson, St Monans – One steam drifter

Scott of Kinghorn, Ltd., Kinghorn

†Steel Screw, Passenger and Cargo ..	Steel ..	Melbourne..	1500	1500	1850
†Steel Screw, Passenger and Cargo ..	do ..	do ..	750	750	1100
				2,250	2,950

J. Weatherhead, Eyemouth One steam drifter and one sailing boat

The Caledon Shipbuilding & Engineering Co., Ltd., Dundee —

		I H P	pres lbs
†Hilary ..	Liverpool	6275	1000
†Lady McCallum	Glasgow	1600	1000
†No. 205 S S ..	Singapore	1280	1800

† Triple. ‡‡ Compound Surface Condensing. *f* Compound Non-Condensing.

Alexander Hall & Co., Ltd., Aberdeen.—Six vessels with a gross tonnage of about 540 tons and an I H.P of about 1080.

Engines, etc.

J. Abernethy & Co., Aberdeen. Fourteen sets of engines and boilers for drifters and trawlers

Aitchison, Blair & Co., Clydebank

		I H P	Pres lbs
‡‡Twin-Screw	Foreign	340	150
‡‡Twin-Screw, Disconnecting	do	90	120
		430	

J. Cran & C ., Leith.

2 Sets Compound Engines each 780 I H P

2 Sets ,, for Fishing Drifters, each 200 I H P

Fisher & Co., Ltd., Paisley.

		I H P.	Pres lbs
‡‡1 Vessel ..	P McGregor & Sons,.. ..	225	130
‡‡	,, ...	225	130
	Total ..	450	

Gourlay Brothers, (Dundee) Ltd., Dundee.

† 1 Set 4000 I H.P †3 Sets 4500 I.H.P. †3 Sets 4500 I.H P

Name of Vessel.	Built of	Owners	G T Regis	G.T. inclu. erect.	I H P
Titania	Steel	Foreign	3,470	—	4,000
† Baron Gaubach .	,,	,,	1,990	—	4,500
† Prinz Hohenlohe	.	..	1,990	—	4,500

White & Hemphill, Ltd., Roxburgh Engine Works, Greenock – Engines, 670 I H P Also large amount of repair work and general engineering

Allan, Anderson & Co., Eastwood Engine Works, Pollokshaws, Glasgow.

		I H P.	Pres. lbs.
* ..	The Larne Shipbuilding Co Ireland	280	130

Campbell & Calderwood, Soho Engine Works, Paisley.—Three sets of stern-wheel machinery. The outlook for the immediate future seems to them very bad indeed

Cooper & Greig, Dundee.—Two sets of triple engines, total H.P 1400, foreign owners. Two sets of compound engines, total H P. 400 home owners.

Clyne, Mitchell & Co., Aberdeen —

		I.H P	Pres. lbs.
* ..	Wm. Geddes, Port Gordon..	195	140
† ..	Wm McIntosh & Son, Buckie	200	180
* ..	,, ,, ...	195	140
† .	Alex Slater, Lossiemouth ..	200	180

IRISH.

The Dublin Dockyard Co., North Wall, Dublin Twin-screw fishery cruiser for Department of Agriculture and Technical Instruction for Ireland, and Combined Coal and Water Barge for Gt. Western Railway

The Larne Shipbuilding Co., Larne.—Steel steam drifter, 86 ft × 18 ft 6 in × 9 ft 10 in

WORK ON HAND IN FOREIGN YARDS.

FRENCH.

The French Engineering and Shipbuilding Co., Dunkirk.—Five Steamers of 11,000 tons gross

A. Normand & Co., Havre.

t Cavalier	Destroyer	French	445	8,000
t Chasseur	..	.	435	8,000

Caillard & Co., Havre.

†x (Trawler)	. Baheux frères Boulogne s. mer ..	600	200

Schneider & Co., Creusot.

† Edgar-Quinet	Cruiser	Brest	14,870	36,000

BELGIAN.

Chantiers Navals Anversois, Hoboken-by-Antwerp.

Ingeltingen, St. Johann, Javorina .., Opping .. — All similar to vessel launched, the Slawentzitz, and now on stocks.

Aug. Hamman, Ostend.

One new Dandy Cutter, wood, for Ostend, about 40 register tons, for fishing purposes, will have a steam donkey. One new Cutter, wood for Ostend, about 12 register tons for fishing purposes, and some repairs.

* Compound. † Triple. ‡‡Compound Surface Condensing. *t* Turbine. †x

Societe Anonyme John Cockerill, Hoboken.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
m Sunsk-moi	Steel—	Russia	—	9	60
m Badineur	,, —	—	—	9	60
a Bagdad Paddle-wheel Boat	,, —	Turkey-in-Asia	484	680	850
a Basra ,,	,,	—	484	680	850
m Screw Boat	,, —	Congo	—	12	125
‡Membéré Stern Wheel	,,	,,	19	26	650
‡Stern-Wheel	,, —	China	19	26	65
Paddle-Wheel Boat	,, —	Russia	640	1826	850
8 Barges	,,	Turkey-in-Asia	—	190	
1 Canoe	,, —	The Philippines	—	37	—
‡Screw Tug	,, —	Congo	7	8	30
‡Screw Tug	,, —	,,	9	10	30

DUTCH.

The Arnhem Co., Arnhem. The work on hand consists of 14 vessels (all tugs), with a displacement of 2,335 tons, with 14 triple-expansion engines, totalling 4,535 I.H.P., and 15 marine boilers with a total heating surface of 17,700 sq. feet.

Gebr. G. & H. Bodewes, Martinshoek.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
2 Barges	Steel	—	Hamburg	100	—
1 River Lighter	,,	—	Rotterdam	790	—
1 ,,	,,	—	Bergen op Zoom	950	

Bonn & Mees, Rotterdam.

† Menado	Steel	—	Rotterdam	5,000	2,500
† No. 190	,,	—	,,	5,000	2,500

Jonker Gebr. Scheeps Baumeisters, Kinderdyk.

3 Lighters, 3,000 tons d.w.

K. J. Koopman, Dordrecht.

* No. 47	Steel	Tug	—	—	130
* No. 48	,,	,,	—	—	130
* No. 49	,,	,,	—	—	175

Maatschappij voor Scheeps-en-Werktuigbouw, "Fijenoord," Rotterdam.

† Le Maire	Steel		Batavia	2,907	1,600
† Van Spilbergen	,,	,,	,,	2,907	1,600
† De Haan	,,	,,	,,	1,650	1,150
† Reyniersn.. ..	,,	,,	,,	1,650	1,150
† Swaerdecroon ..	,,	,,	,,	1,650	1,150
† 4 Torpedo Boats	,,	,,	Dutch Gvt.	160dis	2,000ea
* No. 222 (Life-boat)	,,	—	Koch Van Holland	30	140

J. Meyer's Shipbuilding Co., Zalt Bommel.

† 1 Cargo Steamer	Steel	—	Norway	1,600	600
Several Barges	,,		Germany	1,500	—

B. A. Mittendorff, Dedemsvaart.

——	Steel	—	Aak	120	—
——	,,	—	Klipper	170	—
——	,,		,,	190	—
——	,,		Aak	90	—

The Nederlands Shipbuilding Co., Amsterdam.

† Saramacca ..	Steel		—	2,900	2,600
Carl Broms ..	,,	—	Amsterdam	80	—
3 Lighters ..	,,	—	,,	80ea	
† Czaar Peter ..	,,	—	Alkmaar	275	350
	,,	—	,,	275	350
† Van Hovin ..	,,	—	Batavia	1,600	1,100

A. J. Otto & Sons, Krimpen a.d. Yssel.

1 Lighter	—	—	—	250	—
,, ...	—	—	—	1,500	—
,, ...	—	—	—	750	—
,, ...	—	—	—	1,100	—

J. J. Pattje & Son, Waterhuizen, nr. Groningen.

1 2-mast Schooner ..		—	German	150	
1 Tjalk	—	—	—	80	—
1 mast Mastjalk				90	

* Compound. † Triple. ‡ High Pressure. *a* Quadruple. *m* Motor.

Rotterdamsche Droogdok Maatschappij, Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G T Regis	I.H P
† s.s. Soenka ..	—	—	Gothemburg	1,200	900
† s.s. Seine (Sea-going Screw Tug)			—	400	800
Neerlandia (Sea-going Oil Lighter)			—	800	—

The Royal Shipbuilding and Engineering Co., De Schelde, Flushing.

5,200 tons tonnage
6,750 I.H.P. engines.

P. & A. Ruztenberg, Waspik.

1 Vessel	—	—	Waspik	520	—
1 Vessel		—	,,	1,065	—

Jan Smit Co., Alblasserdam. Lighters, No. 444, 445, 446, 447, 448.

Van Vliet & Co., Hardinxveld.

No. 62 ..	Steel	Steamer	London	900	—
,, 63	,,	Barge	Rotterdam	1,830	—
,, 64	,,	Barge	Rotterdam Duisburg	1,830	
,, 65	,,	,,	Belgie	1,500	—

A. Vuijk & Zonen, Capelle a/d Yssel.—1 sea-going Lighter, 1 sea-going Tugboat, 3 River Barges; total approximate tonnage, 4,500 tons.

N. V. Werf v/h Rijkee & Co., Rotterdam.

2 steel Tugs, 400 I.H.P. each; 2 Steel Cargo Steamers, 2,000 tons gross, 1,000 I.H.P. each.

The Alblasserdamsche Engineering Works, Alblasserdam.

† Atlas	N. V. Werf Vh. Rykee & Co.	430	180
† 2 Vessels	Werf Baanhoek	240ea	180ea
† Czar Peter ..	Ned. Scheepsbouw & Co.	380	180
†	,, ,, ,,	380	180
† -	Theisfing en Oostlander..	375	200

Der Kinderdijk Engineering Works, Kinderdijk.

† No. 528	T. & K. Smit's Scheepswerven	600	180
† ,, 529	,, ,, ,,	200	180
* M.O.P. 111B ..	,, ,, ,,	360	120
† Roodezee	,, ,, ,,	1,250	165

Stock Bros. & Co., Hengel.

† 1 Tug Boat ..	Werf Conrad	340	170
* 1 Bucket Dredger	,, ,, ...	150	125
* 1 Suction ,,	,, ,, ...	225	125

Wilton's Engineering and Slipway Co., Rotterdam.

† Fiat Voluntas 12 Tug	Duyvendyk	650	200
† Trawler	Gebr. v/d. Windt	200	180
† Trawler	Duyvendyk	650	200
† Combinatie, Tug	—	650	200
† Trawler	Gebr. v/d. Windt	200	180
† Fiat Voluntas 2 Tug	—	550	200
† Risico 2 Tug ..	—	550	200
* 3 Trawlers ..	Gebr. Tigee	100ea	150ea

Wed C. Boele & Son, Slikkerveer.

1 Vessel	Rosario	600	—	—
1 ,, ...	Rosario	600	—	—
1 ,, ...	Dordrecht	1480		—

J. Drewes & Co., Ijzeren Scheepsbouw bij Groningen.

†Castor III	Steel	Bremen	325
*	,,	Hamburg	150

Firma A. F. Smulders, Schiedam.

Nos	Type	Destination.	Tonnage.	I.H.P.
*330 ..	Bucket Dredger ..	..	320	.. 200
*331 ..	Suction Dredger ..	..	300	.. 450
*338 ..	Dredger	Belgian acct ..	400	.. 600
*339 & 340	Floating Cranes ..	Argent acct...	900ea..	750ea

* Compound. † Triple.

GERMAN.

Actien Gesellschaft "Neptun" Rostock Schiffswerft und Maschinenfabrik.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
† 269	Steel	Steam	Rostock	1,600 *n*	700
† 276			,,	1,650 ,,	700
† 277 and 278 ..	,,	,,	Hamburg	4,000ea.,	1,300ea

Actien-Gesellschaft "Weser," Bremen.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
† Gneisendu ..	Steel	—	Wilhelm-haven	8,200	26,000
Linienschiff (163)	,,	—	,,	—	—
a Fracht & Passag Du (164) ..	,,	—	Bremen	17,000ab	14,000

Flensburg Shipbuilding Co., Ltd., Flensburg.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
Niagara	Steel	—	Hamburg	7,200	3,000
No. 278	,	—	—	4,200	2,200
Adelheid Menzell	,,	—	Hamburg	4,850	1,800
Elsa Menzell ..	,,	—	,,	4,850	1,800
Helène Menzell	,,	—	,,	4,850	1,800

Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
† 2 Cargo and Passenger Steamers	Steel		Hamburg	—	4,500ea
Schooner Yacht	,	—	Kiel	—	—
† Warship Tender	,,	—	,,	765	1,600
† Scheswig-Holstein	,,		,,	9,030	10,000
2 Submarines ..	—	—	Austria	—	—
1 Submarine ..	—	—	Norway	—	—

Heinrich Bradenburg, Hamburg.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
* No. 226	Steel	Elevator	Hamburg	310	125
,, 227 & 228	2 compos.	Lighters	,,	50	—
* ,, 229	Steel	Tug	,	27	80
* ,, 230	,,	,,	,,	32	150
* 231 & 232,	2 Wood	Launches	Foreign	7ea	18ea

R. Holtz, Harburg.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
3 Vessels	Steel	Steam	Foreign	31	90ind.
2 ,, ...	,,	Lighters		27	—
1	,,	Lifeboat	,,	2	—
1 ,, ...	,,	Steam	German	20	80in.d

C. Luhring, Brake, I.O.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
Neuban No. 85	Steel	—	Harburg	205	
* 3 Vessels	,,	—	Brake	125ea	100ea

J. L. Meyer, Papenberg.—4 tugs, total 205 tons and 485 H.P.

Nuscke & Co., Stettin-Grabow.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
12 Vessels ..	Steel	—	Stettin	170	—
† 165	,,	—	,,	720	450
* 166	,,	—	,,	27	60
* 167	,,	—	,,	535	350
* 168	,,	—	Swinemund	75	150
Ponton	,,	—	Stettin	18	—

Reiherstieg Schiffswerfte und Maschinenfabrik, Hamburg.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
**Roda, No. 423 ..	Steel	Schooner twin-screw	Hamburg	7,200ab *n*	3,500

Rickmers & Co., Bremerhaven—about 17,000 tons gross.

Schiffswerft von Henry Koch, Lubeck.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
† s.s. No. 178 ..	Steel	Schooner	Hamburg	2,100 *n*	1,300
* s.s. No. 190 ..	,,	,,	Lübeck	650 ,,	350

George Seebeck A.G., Bremerhaven.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
† 271 and 272 ..	—	Trawlers	Geestemunde	205ea *n*	300ea
† 273	—	2-Screw Tug Boat	Bremen	280 ,,	800
† 274 and 275 ..	—	Trawlers	Geestemunde	265ea ,,	450ea
† 276	—	Tug Boat	Rio Janiero	110 ,	350
† 277 and 278 ..	—	Trawlers	Geestemunde	215ea ,,	350ea

Stocks & Kolbe, Kiel.

Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
No. 135 and 136	Steel	—	—	93	—
m No. 137	,,	—	Emden	29	17 eff.
No. 141 and 143	,,	—	Hamburg	43	—
No. 144			,	290	—

* Compound. ** Triple Compound. † Triple. *a* Quadruple. *m* Motor. *n* Including Erections.

John C. Tecklenborg, A. G., Bremerhaven, Geestemunde.

4 steamers of 18985 tons Reg. and 9500 I.H.P.
18 Lighters .. J. Thormahlen & Co., Elmshavn. Steel, of about 1,890 tons

Vulcan & Co., Stettin.

Name of Vessel	Built of	Class.	Owners.	G.T. Regis	I.H.P.
† Ers. Warttemberg	Steel	Battleship	Kiel	11,300 *n*	20,000
t Ers. Tagd	,,	Cruiser	,,	3,100 ,,	19,000
† V151 & V160 ..	,,	Torpedo Boat	Wilhelm-haven	500ea,,	10,500ea
t V161	,,	,,	,,	500 ,,	10,800
a George Washington	,,	Pass. & Fr. Steamer	Bremen	25,500 ,,	20,000

Oderwerke Actien Gesellschaft, Stettin.

Name of Vessel	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* No. 594	Steel	Stettin	152	—	140
† No. 595	,,	,,	60	—	250
† Nos. 596 and 597	,,	Hamburg	800ea	—	800ea
* No. 598	,,	Flensburg	300	—	300

G. H. Thyen, Brake, a d Weser.

Name of Vessel	Built of	Owners.		G.T.	I.H.P.
S21 Aussneider Fireship	Steel	Tönning		about 290	sailing
S22 Steam Trawler	,,	Brake	—	146	100

Howaldwerke, Kiel.

Name of Vessel			G.T.	I.H.P.
9 Steamers .. .. 4 Pontoons .. .. 2 Floating Docks 1 Dredger	—	—	7385	3210

T. A. Hitzler, Lauenburg, Elbe

Name of Vessel	Built of	Class		G.T.	I.H.P.
*S 215	Steel	Stm. Tug	—	—	400
S 216	,,	Lighter	—	210*t*	—
S 217	,,	,,	—	210*t*	—

Gebr. Sachsenberg, of Rosslau and Dantz.

Name of Vessel	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
*Loreley	—	Pass. stmr	Düsseldorf	547	650
†Mecklenburg ..	—	Elbe steam tug	Hamburg	542	600
*One vessel ..	—	Dredger	Stettin	405	270
†Deutscbland ..	—	Elbe steam tug	Hamburg	553	800
†Vessel	—	,,	,,	553	800
*Herrog Friedrich von Anhalt ..	—	,,	Dresden	370	500
*Vessel	—	,,	,,	370	450
Kronprinz Georg von Sachsen ..	—	,,	,,	283	450
*Vessel	—	,,	,,	283	450
† ,, ...	—	Havela steam tug	Havelburg	252	320
‡ ,, ...	—	Passenger and freight steamer	Congo	45	55
599	—	Pontoon	Cologne	52	—
†Vessel	—	Rhine steam tug	Duisberg	300	650
Ana Catarina ..	—	Freight steamer	Cochabamba	25	36

North German Lloyd, Bremerhaven.

Name of Vessel	Builders.	I.H.P.	Press. lbs
a George Washington	* Stettiner Vulcan ..	20,000	213
a Prinz Friedrich Wilhelm ..	J. C. Tecklenborg, Geestemunde ..	13,500	221
a Lützow	Act. Ges. Weser, Bremen	6,000	221
a Neuban 164 ..	,, ,, ,,	14,000	221
a Derfflinger ..	F. Schichau, Danzig ..	6,000	221
a Giessen	Bremer Vulkan, Vegesack	2,800	221

* Compound. † Triple. ‡ High Pressure. *a* Quadruple. *t* Turbine.

DANISH.

Actiese'skabet Burmeister & Wains, Maskia o.g. Skibsbygerri, Copenhagen.

Name of Vessel	Built of	Class.	Owners	G.T Regis	I H.P
† Screw Steamer	Steel	Schooner	Copenhagen	2,486*n*	1,350
† s.s. No. 261 ..	,,	,,	,,	930 ,,	530
† s.s. No. 263 ..	,,	,,	,,	600 ,,	1,500
† s.s. No. 264 and 266		..	Christiania	4,000ea.,,	1,700ea
† s.s. No. 267		..	Copenhagen	1,200 ,,	1,850
† s.s. No. 268 .. ,,		,,	,,	3,500 ,,	1,700

Actieselskabet Kjobenhavns, Flydedok o.g. Skibsværft.

† No. 69	Steel	—	—	775	550
,, 70/71	,,	—	—	ab 200	—
† ,, 72	,,	—	—	760	400
* ,, 73	,,	—	—	ab75	150
,, 74	,,	—	—	ab300	—
† ,, 75/76		—	—	1,550	1,100
† ,, 77	,,		—	ab750	500

Elsinore Iron Shipbuilding & Engineering Co., Elsinore.

† No. 118	Steel	Steam	Not yet fixed	1,550 *n*	650
* No. 119	,,	,,	Copenhagen	not fixed	400

SWEDISH.

Bergsunds Mekaniska Verkstads Aktiebolag, Stockholm.

† Torpedo boats Spica & Mitrea	Steel	—	Stockholm	dis 110ea	1900ea
* Passenger steamer for Odessa ..	,,		..	220ab *n*	480
* Passenger steamer for Ljester ..	,,		,,	190ab ,,	270

Eriksbergs Mek. Verkstads Aktiebolag, Goteborg.

* 2 steamers ..	Steel	Screw Steam	Goteborg	192ea	120ea

Goteborgs Nya Verkstads Aktiebolag, Goteborg.

s.s. 297 and 298, 1st-Class Torpedo boats, R. Swed. Navy.

† s.s. 300	Steel	Cargo	Swedish	640	400
† s.s. 301	,,		,,	200	200
† s.s. 302	,,	..	,,	500	450

Kockums Mekaniska Værkstads Aktiebolag, Malmo.

† Ragnar	—	Destroyer	Swedish Gvt.	—	7,500
* No. 94	Steel	Schooner	Eskitstuna	—	200

The Lodose Wharf Co., Ltd., Lodose, Goteborg.—

One 700 t.d.w. and One 500 t.d.w. steamer for early delivery, 1908.

Motala Verkstads Nya Aktiebolag, Motala.

2nd class Torpedo boats 13, 14 15 ..	—	—	—	—	—
* Tug steamer ..	Steel	—	—	—	210
† Steam passenger	,,	—	—	—	130

Oskarshamns Mekaniska Værkstads och Skeppsdockas, Aktiebolag, Oskarshamns.

* No. 231 .. .	Steel	Tug	Wisby	—	85
m No. 232	,,	Cargo	Gunnsby	—	50
m No. 233 & 234 ..		..	Stockholm	250ea *n*	130ea

* Compound. † Triple. ** Triple Compound. *m* Motor.

NORWEGIAN.

Akers Mek. Værksted, Christiania.

Name of Vessel	Built of	Class.	Owners	G T Regis	I H P
† 258 & 261 ..	Steel	—	Bergen	ab 1,005ea *n*	ab 800 ea
† 263		—	Haugesund ..	1,130	680
† 266		—	Kristiania ..	1,130	680
† 267		—	.. ,,	1,715	1,100
† 270		—	Leith ,,	109	370
† 271 & 272 ..		—	Kristiania ,,	109ea	370ea
† 273		—	Tönsberg ,,	109	370
† 274			Bodo ,,	325	360

Summary—

1 Passenger and Cargo Steamer	325 *n*	360
5 Cargo Steamers	5,985 ..	4,060
4 Whaling Steamers	436 ..	
	6,746	5,900

Aktieselskabet Fredrikstad Mek. Værksted.

† s.s. 119	Steel	Steam	Tönsberg	1,550 *n*	1,150
† s.s. 120		.	Kristiania	1,525 .	1,150

Laxevaags Shipbuilding & Engineering Co., Bergen.

† s.s. No. 88 ..	Steel	—	Bergen ab.	1,715 *n*	800
† .. 89 ..	,,	—	Helsingfors ,,	1,105 ..	650
† .. 90 ..	,,	—	Haugesund ,,	1,105 .,	650
† .. 91 & 92 ..		-	Bergen ,,	1,105ea.	650ea

Nylands Værksted, Christiania.

† Skotfos .. .	Steel	—	Christiania	1,220ab	650
† Juan	..		Flekkefjisd	1,450 ,,	1200
† No. 185	,,		Brazilien	975 ,,	800
† Hjorleifer ..			Iceland	117 ,,	280
† Yon Signodsson		—	..	117 ,,	280
† No. 188		—	Christiania	112 ,,	280
† No. 189			.	650 .,	450
† No. 190		—	Iceland	117 .,	280
† No. 191 .. .			Tönsberg	117 ,,	280
† No. 192			Christiania	1,260 ,,	850

Porsgrunds Mek. Værksted, Porsgrund.

* No. 50 .. .	Steel	machinery aft		650 *n*	450
* .. 51				130 ,,	150
* .. 52	..	Tug	—	30 ..	100
* 53			—	650 ,,	350
			Also 1 engine	.	160
			and ,,	..	100

Stavanger Stoberi & Dok, Stavanger.

† s.s. 56	Steel	Schooner	Kangesund	1,081ab*n*	680ab
† s.s. 57	..	..	Stavanger	997ab.,	900ab
† s.s. 58	..	.	..	450ab.,	650ab

Trondhjems Værkstad, Drontheim.

† Tromso	Steel	Steamer	Tromso	260 *n*	250
Orkla	.	..	Trondhjem	200 ,,	600
Passenger Steamer ..		..	..	120 ..	250
Cargo Steamer		..	..	1,200 ,,	900

AUSTRIAN.

The Austrian Lloyd, Trieste.

Name of Vessel	Built of	Class	Owners	G.T Regis.	I H P
† Praga, Bregeur, Nos. 114 & 115	Steel	2 Pole masts	Trieste	3,891ea	3,200ea
* Dredger No. 110	..	—	,,	—	—

Marco U. Martinolich, Lussinpiccolo.

No. 145 (Sister ship of the Maros).

† No. 146	Steel	Screw Steamer	..	200 *n*	610H.P

120′ × 17′ 8″ × 9′ 3″

No. 147 (Sister ship of the No. 146).

* Compound † Triple *n* Including Erections.

HUNGARIAN.

Danubius Shipbuilding & Engineering Co., Ltd., Budapest.

Name of Vessel	Built of	Class.	Owners	G T Regis	I H P
8 Lighters ..	Steel	—	—	2,700	—
† 1 Tug Boat ..	,,	Screw	Ibrail	150	300

Erst Ku K. Priv. Donau Dampfschiffahrts, Gesellschaft, Budapest.

* One side Paddle Wheel Steamer for passenger service	Steel	—		—	900

E. K. K. p. Donau Dampfschiffahrts Gesellschaft, Vienna.

10 Barges	—	—	338 tons	

The Lazarus Works (Stabilimento Lazarus), Fiume.

Tugs for the Admiralty.

Stabilmento Tecnico Triestino, Trieste.

3 Battleships of 14,500 tons displacement and 20,000 I H P each

1 Turbine plant of 20,000 I H P for 3,500 tons cruiser, for the Austro-Hungarian Navy

2 Armoured River Guard Vessels of 680 tons displacement and 1,800 I H P, for the Roumanian Navy.

No. 381 Motor Launch of 7 tons gross and 60 I H P

No. 382 Motor Launch of 70 tons gross and 160 I H P, for Trieste.

No. 383, Twin-screw Passenger Steamer for coast service of 160 tons gross and 650 I.H.P., for Trieste

No. 384 Passenger Steamer for coast service of 244 tons gross and 650 I H P

No 385/6, 2 Passenger Steamers for coast service of 190 tons gross and 400 I H P. each, for Fiume

No. 387/8, 2 Passenger Steamers for coast service of 220 tons gross and 400 I H P each, for Sebenico

ITALIAN.

Amerigo Gori, Leghorn.

Name of Vessel	Built of	Class.	Owners.	G T Regis	I H P
Y. Assunta ..	Wood	Brig	Leghorn	135	—
Renato	,,	,,	,,	150	—

N. Odero & Co., Cantieri de Fore, Genova.

Amalfi	—	—	—	—	—
† 1st-class Cruiser	—	—	Italian Navy	10,000 dis	19,000

Societa Esercizio Bacini, Genoa.

† Principessa Mafalda	Steel	—	—	9,000	10,000ab
† s.s. No. 44 ..	,,	—	—	650	500

Cantieri Navale Di Muggiano, Spezia.

† No. 47	Steel	—	Genoa	8000	7000
† No. 48	,,	—		[illegible]	7000

SPANISH.

The Euskalduna Shipbuilding Co., Bilbao.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
† s.s. Ganecogostamendi	—	Schooner	Bilbao	2,999*n*	246NHP

AMERICAN.

The American Shipbuilding Co.—All Yards.

17 Steamers .. — — — 78,600

Bath Iron Works, Bath, Maine.

Steamer Belfast, sister-ship to Camden, same details as vessel launched.

U.S. Scout, Cruiser Chester .. .. Steel material Turbine Engines.

U.S. Destroyers Nos. 20 & 21 Steel, Turbines.

*Compound. † Triple.

H. D. Bendixson Shipbuilding Co., Eureka, Cal.

Name of Vessel	Built of	Class	Owners	G T Regis	I.H P
Shoshone	—	Steam Schooner	—	600*n*	—
Katherine	,,	,,	—	525,	—

William A. Boole & Son, Oakland, Cal.

One oil barge for Standard Oil Co., being built of wood with their steel oil tanks, 7 ft. 6 in. by 100 ft. long each, for transportation of oil on S. F. Bay and its tributaries; one wooden swag scow for U.S. Engineers for improvement of Sacramento and Frather Rivers. Dimensions 28 ft. by 64 ft. by 3 ft; and one wooden tug boat, length over all, 71 ft. 6 in., beam moulded, 17 ft., depth of hold, 7 ft., one set compound engines, $\frac{9'' \times 21''}{18''}$ oil fuel Scotch marine boiler for W. A. Boole & Son.

Buffalo Dry Dock Co., Buffalo.

Canadian Pacific Railroad Company's Steamer Assiniboia being joined together after being cut apart to pass through the Welland Canal. The steamer Keewatin, also belonging to the same line, and a sister-ship, now *en route* from Montreal, will be joined in a similar manner to the Assiniboia; the Keewatin is expected to arrive in Buffalo, November 20th.

Not named ..	Steamer	Buffalo		Excursion boat
,, ...	,,	—		Coarse freighter

The Burlee Dry Dock Co., Port Richmond, N.Y.

c 434	Steel Lighter	New York	278 net	—
† 439	,, Tug	,,		—

G. G. Deering Company, Bath, Maine.

They have a 4-master schooner on the stocks, which is all ready for the masts to be stepped, and will probably launch in five or six weeks. She will be between 1,300 and 1,400 tons gross.

J. H. Dialogue & Son, Camden, New Jersey.

One steel Tug building for Jas. McWilliams Co.

† Schooner .. .. — Rig — 340ab 700

Fore River Shipbuilding Co., Quincy, Mass.

1 U.S. Battleship, North Dakota, 20,000 displacement.

4 U.S. Light Vessels.

Gildersleeves Shipyard, Gildersleeve, Conn.

1 Coal Barge, duplicate of	Blue Tein		vessels launched.
1 ,, ,,	Raymund		
2 Lighters ,,	Dan		

The Great Lakes Engineering Co., Detroit, Mich.

7 steamers with a total gross tonnage of about 39,400

The Greenport Basin & Construction Co., Greenport.

Oyster Steamer Wood — — — 30

Harlan & Hollingsworth Co., Wilmington, Del.

Miscellaneous repairs.

Lockwood Manufacturing Co., East Boston, Mass.

Cordage Machinery and s.s. repairs.

The Lindstrim Shipbuilding Co., Gray's Harbor, Aberdeen, Wash.

Capastrano .. — — — 745 640

Manitowoc Dry Dock Co., Manitowoc, Wis.

Hulls, 22—23 ..	—	Fire Boats	Chicago Ill.	—	500
Hull 24	—	Sand Sucker	Chicago, Ill.	—	500

Maryland Steel Co., Sparrows Point, M.D.

4 pontoon dredgers for Isthmian Canal Co. to be delivered knock down; 2 sea-going suction dredgers for U.S. Engineers Department, about 2,000 gross tons each; 3 steel pump barges for Isthmian Canal Co. to be delivered knock down.

† Triple. *c* Single cylinder. *n* Including erections.

Moran Brothers Co., Seattle, Washington.

Name of Vessel	Built of	Owners	G.T Regis.	G.T. inclu erect.	I H P
† Riverside ..	.. Steel Str. Sch. rig.	San Francisco	In frame	1,730*n*	850
† Not named	.. ..	..	Plated	1,730*n*	850
† Northland	.. ..	Port Townsend	Keel laid	456*n*	350

Neafie and Levy Ship and Engine Building Co., Penn Works, Philadelphia. Finishing up "Belhaven," "Adriatic" Repairing sundry vessels

Newport News Shipbuilding and Dry Dock Co., Newport News, Va.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I H.P.
North Carolina	Armoured Cruiser		These three vessels for the United States Navy.		
Montana	,,				
Delaware ..	.. First-class Battleship				
† Lurline ..	.. Frt. & Pass. steamship		San Francisco	6,200	3,500
† Texas ..	.. Oil Tank steamship		Port Arthur	5,000	2,800
* Corning ..	.. Steel Tug		New York	180	600
* Bath	.. Steel Tug		,,	180	600
† U.S. Revenue Cutter			U.S. RCS.	1,000	1,500
† U.S. Revenue Cutter			,,	410	1,000
* U.S. Army Engineer's Dredge			U.S. Army	1,000	900
6 Stone Barges	Steel	—	—	862 dis. ea	

New York Shipbuilding Co., Camden, N.J.

† Revenue Cutter, No. 20	Steel	—	U.S.	650*n*	1,400
† ,, No. 21	,,	—	..	650*n*	1,400
t Torpedo Boat Destroyer No. 19	..	—	U.S.N.	700 disp.	10,000
† Anemone, Hibiscus, Orchid, Kukin, Sequeia, Cypress, Tulip and Mauzamta	Lighthouse Tenders		U.S. Texas	550ea*n*	1,100ea
† Oklahoma ..	.. Oil Steamer		Port Arthur Texas	5,800*n*	3,200
† Michigan ..	.. Battleship		U.S.N.	16,000 disp.	16,500

Crawford & Reed, Tacoma, Wash.

* S. G. Simpson, Stern Wheel — 350 H.P.
Length, 118 ft., beam, 23 ft., depth 6 ft.
Gasoline Launch, unnamed. 65 H.P. Gas
Length 71 ft., beam 13 ft., depth 6 ft. 1 in.
Also repair work.

Percy & Small, Bath, Maine.

Have on stocks one 6-masted Schooner of 300 ft. keel, 50 ft. beam, 29 ft. deep, 3,400 tons gross register; also a contract for another duplicate of one above.

Wm. K. Osborn, Croton-on-Hudson, N.Y.

* Zephyr	Wood	N.Z.	106	200

Jas. Rees & Sons Co., Pittsburg, Pa.

R. F. Jones .. Stern wheel Pittsburgh 150 500
Steel Hull with 19 compartments, tandem Compound, 12 × 24 × 6 foot surface condenser, 3 steel boilers, 38 in. diam. by 28 ft. long, for tow boat Nesta Coal Company.

Slun Cauca, stern wheel dredge, 150 tons, gross 250, for use on river Cauca, Republic of Columbia Dredge Boat and Snag Boat.

* Compound. † Triple. *t* Turbine. *n* Including Erections.

Southern Pacific Ry., Oakland, Cal.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
* Melrose	Wood	Steam	San Francisco, California	2,197*n*	1,300ab

(Side-wheel steamer, hull in frame and now planking.)

Arthur D. Story, Essex, Mass.

We have two vessels—Schooners—on stocks of about 138 tons gross; one nearly completed.

The Superior Shipbuilding Co., West Superior, Wisconsin.

2 steel freight steamers to be built this winter, 430 ft. keel, with triple-expansion engines of about 1,400 horse-power.

The Thames Tow Boat Co.

Hauling and repairing.

CANADIAN.

J. Bigelow, Canning, N.S.—Three-masted schooner on the stocks to be launched in June, 1908, about 330 tons nett, 360 gross tons W. H. Baxter is building her for Captain E. Berteaux.

B. M. Cochran, Fox River, N S.—One schooner about 300 ton on stocks. One tug-boat to build and a schooner of about 350 tons.

The Collingwood Shipbuilding Co., Ltd., Collingwood, Ontario.—Nos. 19-20, Steel Hopper Barges, length o.a 122', breadth mld 32'; depth mld 11', 450 cu. yds. capacity steam operating gear.

Joseph McGill, Shelburne, N.S.—Wooden tern schooner, 140 tons gross register, to be registered St. John's, Newfoundland

J. H. Wagner, Mahone Bay, N S.—One 90-ton schooner, one 400-ton steamer

HONG-KONG.

W. S. Bailey & Co., Hong-Kong.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I H.P
‡‡Steam Lighter ..	Steel	—	725	943	600

Geo. Fenwick & Co., Ltd., Hong-Kong.

‡‡Steam Launch ..	Wood	—	—	39	80

Hong-Kong & Whampoa Dock Co., Ltd., Hong-Kong.

†No 433 ..	Steel-Stm.	Manila	132	—	385
*No 435	..	Bangkok	122	—	175
†No 346	..	,,	443	—	385
*Nos. 437, 438 & 439	..	Manila	60ea	—	180ea

Riley, Hargreaves & Co., Ltd., Singapore.

Lighter ..	.. Wood	Singapore	85	100	—
*Launch ..	Wood-Screw	,,	18	18	60
*Launch	,,	,,	28	32	110
*Launch	,,	,,	22	22	80
*Launch	,,	,,	25	28	73
Barge ..	.. Wood	,,	247	247	—

STRAITS SETTLEMENTS.

Singapore Slipway and Engineering Co., Ltd., Singapore. Two teak wood cargo lighters, 64 ft × 17 ft. 6 in. × 7 ft. 8 ins.

Tanjong Pagar Dock Board, Singapore.

Name of Vessel	Built of	Class.	Owners.	G.T. Regis.	I H P
*1 Wood Screw Launch ..			—	45	140
1 Wood Hopper Barge	—	—	Singapore	350	—
2 Steel Hopper Barges	—	—	,,	350ea	—
1 Lighter ..	—	—	—	50	—
*1 Wood Screw Steamer ..	—	—	Billiton	115	215

* Compound. † Triple. ‡‡ Compound Surface Condensing. *n* Including Erections.

JAPANESE.

Hakodate Dock Co., Ltd., Hakodate —Are doing mostly general repairs, shipbuilding is of small vessels only

Kawasaki Dockyard Co., Ltd., Kobe.

Name of Vessel	Built of		G T Regis	G. T. inclu erect.	I H P
†Builders Nos 291-2	Steel	1st cl pass.	—	8600	—
†Siamese Destroyer	..				—
† .. Torpedo Boats	..		—		
†Builders' Nos 298 9		cargo strs		6000	

Mitsu Bishi Dockyard and Engine Works, Nagasaki.

Name of Vessel	Built of	Class	Owners.	G.T Regis.	I.H.P
*t*No 194	Steel	—	Tokio	2940	8500
†Nos 196, 197, 198	..	—	..	8770ea	7000ea
†Nos. 200, 201, 202	..	—	Osaka	6000ea	3900ea
*t*No 203	..	—	Tokio	13,700	16,850
†Nos. 204 & 205 .	..	—	..	9320ea	3500ea

Onos Shipbuilding Yard, Osaka Now have four steamers of an aggregate tonnage of 2000

Osaka Iron Works, Osaka.

†Choshun-Maru ..	Steel		—	—	
†Yard No. 524 ..		.	—	—	
† .. No. 560 ..		..	—	—	
.. No 561	Bucket Dredger (Non-propelling).	..	—	—	Dredging capacity per hour, 200 tons.
.. No 562		..	—	—	
. No 563		.	—	—	Dredging capacity per hour, 80 tons.
.. No. 564		..	—	—	
.. No 565		..	—		
* .. No 567 ..		..	—		

AUSTRALIAN.

Adelaide Steamship Co., Adelaide, S. Australia.

† Paringa . 1,000ab .

Morrison & Sinclair, Balmain, N.S.W.

Motor Yacht .. . Kauri and Teak Sydney 300 h p. 3 separate engines 3 propellers (Thornycroft)

Walkers' Ltd., Maryborough, Queensland, Australia.—Nine new marine boilers, 9 ft 6 in. diameter by 9 ft. 6 in long, are at present under construction

INDIAN.

Burn & Co., Ltd., Howrah, Bengal —The work on hand includes 6 barges of a total tonnage of 1200, 1 steam launch of 60 tons 1 steam launch of 20 tons and several smaller craft.

* Compound. † Triple. *t* Turbine.

BOARD OF TRADE EXAMINATIONS.

Note—1C denotes First Class, 2C Second Class

October 26th, 1907

Smith, Louis .. 1C Greenock
Smith Lionel J 2C London
Smith, William 2C Aberdeen
Surman Arthur 2C Bristol
Weeks, Fred T 2C Sunderl'd
Westerman, A S 1C Hull
Whitehead F 2C N Shields
Youngson, Alex 1C Aberdeen

November 2nd

Baird, Robt W 2C Glasgow
Barr, Samuel .. 1C Belfast
Barrie, Chas S 2C Glasgow
Bould Harold .. 2C London
Brathwaite O.L 2C Liverpool
Bruce, Fredk. T 2C N Shields
Burnip, William 1C Cardiff
Campbell, R. S. 2C N Shields
Carswell, Robt 1C Glasgow
Chew Arthur .. 1C London
Croft, Thos S 2C London
Davis Chas H 1C London
Duncan, M B 1C Glasgow
De Sausmarez, C M 1C Liverpool
Evans David 1C Cardiff
Everson, Jas G 1C N Shields
Finlayson T M 1C London
Geddes, Wm .. 1C Glasgow
George T W 1C Cardiff
Gingell, L B .. 1C London
Gray, Henry J 2C London
Halliday James 1C N Shields
Hardy M C .. 1C Liverpool
Hastie Alfred .. 2C N Shields
Hogan P J N 2C London
Houston Alex 1C London
Hutcheson, S .. 2C Glasgow
Hutton D B... 1C London
Jones, Daniel E. 2C Cardiff
Jones, Benj E 2C Cardiff
Kerr, Andrew .. 2C London
Lockie, Thos C 1C Leith
Mackenzie, John 2C London
Manes is Basile 1C Liverpool
McWilliam D 1C London
McNeil, Robt J 2C Leith
Moves, Alex B 2C Glasgow
Noble, Herbt B 2C Liverpool
Oakley, T V .. 2C Liverpool
Pilmour, J G 1C N Shields
Rees, Thos G 2C London
Roberts, H. L 2C Falmouth
Robertson, J. C 1C N Shields
Scott, Robert .. 2C N Shields
Scott, Joseph 2C Belfast
Struthers, A .. 2C Glasgow
Sutherland, A 2C Glasgow
Tate, A S W 2C London
Urwin, John .. 1C N Shields
Waddell, Arch 2C Glasgow
White, Arthur 1C Liverpool
Wilson, Edmund 1C Leith
Yorke, N D McG. 1C Glasgow
Young, George 1C Glasgow

November 9th

Baird, Arthur G 1C Liverpool
Brannon, B R. 2C London
Callister, Walt. 2C Liverpool
Dwyer, F. H... 1C Liverpool
Fry, Edward G 1C N Shields
Gliscott, G J 1C Liverpool
Griffiths, A J. 1C Liverpool
Heslop, H. W. 1C N.Shields
Holmes, George 2C Liverpool
Maccabe, A J. 1C Liverpool
McGeoch, Alex. 2C Liverpool
McMenemy, J 2C Liverpool
Miller, Geo W 1C N Shields
Pensenev, S O 2C London
Ribton, Reg H. 2C Liverpool
Stuart, Chas. G 2C Liverpool
Thompson, Q H. 2C N Shields
White, John .. 1C London

November 16th.

Armstrong, J J. 1C N Shields
Bailes, Stanley 1C N Shields
Bathgate, James 2C N Shields
Bell, Alfred .... 1C Dundee
Bennett, Robert 1C Greenock
Bruce, Robert.. 1C N Shields
Clarke, Frank.. 1C N Shields
Collings, J H 2C London
Copeland, J W. 1C Liverpool
Coulbeck, W B 2C Hull
Cox, John J .. 1C London
Davies, Ernest 1C Hull
Douglass, Wm 2C N Shields
Durrant A G 2C N.Shields
Fairless Thos. 1C N Shields
Ferguson, F A 2C Liverpool
Fox, Augustus 1C Liverpool
Gardiner, Robt 2C Greenock
Griffiths, T S 2C London
Hagan, W S .. 1C London
Hawke William 1C Hull
Healey, Tom H 2C Hull
Heywood W B 1C Liverpool
Jacobs, William 2C London
Johnstone, F H 2C London
Marmion, Chas 1C Dublin
Meager W M 1C London
Mellish, Frank 2C London
Murphy, Jas L 1C London
Paterson Robt 1C Greenock
Pavitt, Fredk C 1C London
Pert, David .... 1C Greenock
Quintaba, Q A 1C London
Ritchie, F G .. 2C Dundee
Robertson, A .. 1C Greenock
Robinson, Jos. 2C N Shields
Russell, Max S 2C Greenock
Staton, R W .. 2C Hull
Stoves, Anthony 2C N Shields
Sutherland W 1C Liverpool
Tannahill, Jas 1C Greenock
Tose, Rich C 2C N Shields
Tuck Ernest E. 1C London
Waterhouse, F S 1C Hull
Wolsey, W G 1C N Shields

November 23rd

Allen, Fredk W 1C Liverpool
Allen, S C V 1C South'ton
Andrew, Charles 2C London
Atkinson, S .. 1C W Hart'l
Bell, Fredk H. 1C Barrow
Brawley, W J 2C Cardiff
Brown, Peter N. 1C London
Burdis, Wm. D 2C Liverpool
Burdock, Arthur 2C South'ton
Callister, R. H 1C Liverpool
Carmichael, D. W, B. 2C Glasgow
Carr, John C .. 1C W. Hart'l
Carter, Frank.. 2C London
Chisholm, R. .. 2C Leith
Clark, Robt A 2C Leith
Crofton, M P 2C W Hart'l
Cunningham, H. 2C Glasgow
Donaghe, W S 2C W Hart'l
Driver, John W. 2C N Shields
Enright Eugene 2C W. Hart'l
Farrell, R J. .. 2C Liverpool
Gardner, W. A. 1C W Hart'l
Govan, A D. .. 1C Liverpool
Greve, M. C. .. 2C Cardiff
Hamilton A .. 2C Glasgow
Herries, J hn S. 1C Liverpool
Higginbotham, George 2C N.Shields
Hussey, P. G .. 2C South'ton
Hutchison, W 2C Leith
Imeson, J. M .. 2C N Shields
Jamieson, Robt. 2C Leith
Johnston, James 2C Barrow
Johnston, J. H. 1C N Shields
Johnston, P M 1C Glasgow
Kyd, Thomas .. 2C Cardiff
Kydd, John J... 2C South'ton
Lockerbie, C .. 2C Glasgow
Macdonald, Donald W 1C London
Mackenzie, C E 1C Cork
Maclin, Alf B 1C London
Martin Jos B 1C Liverpool
Masonparry, Osmond R 1C Liverpool
McAllister, Jas. 2C Glasgow
McInnes, Neil.. 1C Glasgow
McIntosh W D 2C Glasgow
M'Gregor, L W 2C London
Munro, Hector 1C Glasgow
Neill, Wm T .. 2C Leith
Newman F W 1C Cardiff
Paxton, H C 2C South'ton
Ray, Arthur R 2C W Hart'l
Rischmiller H 2C N Shields
Ritchie, D J M 2C Leith
Rogers, T G .. 2C Cardiff
Rosser, T E .. 2C Cardiff
Rowe, Herbt J. 2C London
Smethurst Wm. 2C Liverpool
Smith, John G 1C N Shields
Spedding, I E 1C N Shields
Stevenson Jas 1C Leith
Stewart, Gordon 1C Glasgow
Tait, C B J .. 2C N Shields
Thompson, W 2C London
Thomson, John 2C N Shields
Todd, Percy J 2C N Shields
White, Fredk E 2C N Shields
Wright T E .. 1C Liverpool

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

Work of the Year.—Writing within measurable hail of the completion of 1907, it is possible to forecast, with a fair degree of accuracy, the result of the year's doings as regards output of tonnage. Activity, on the whole, has distinguished the better part of the year, but for some months past many of the larger yards have been booking no fresh contracts, and in fact now make but a very poor show as regards work on the stocks. In consequence, although the actual figures for the number and tonnage of vessels launched during the year will not likely fall short of the record figure of last year by more than 10,000 or 15,000 tons (the tonnage merely of an average-sized "big ship," as such things go nowadays), the great dearth of new work now so evident will tell heavily on next year's doings, at any rate for the first quarter of the year, if not longer. Important Government work cannot be said to be in prospect, although very substantial contracts for mail and passengers steamers are likely to be received shortly. Clyde shipbuilders, when the year closes, will have launched, big and little, considerably over 400 vessels, aggregating about 585,000 tons, or only some 13,000 tons short of last year's record aggregate of 598,000 tons. The fact that the number of vessels included in this estimate is in the region of 100 short of the 300 going to form last year's output is accounted for largely by the other facts that such huge steamers as the *Lusitania*, *Agamemnon*, etc., form contributary items, and that an exceptionally great number of very small vessels are included in the return for 1907. This indeed, forms a feature of the year's work; although, of course, large high-powered steamers are not wanting from the list. For example, one firm included in the list of builders have to their credit no fewer than 26 vessels (or "items"), the total tonnage of which is only 3099. Another firm has 27 vessels of 2,700 tons, another 26 of 3,660, another 26 of 5,770, another 18 of 1885, while still another on the list has 10 vessels amounting only to 297 tons. The great majority of these craft have not been launched or "floated," in the ordinary sense, but have been shipped abroad, either in pieces or whole on the decks of larger vessels. While the business done in these small craft has thus been exceptionally large, highly important productions have emanated from most of the large establishments; but of these, readers will gather a striking idea from the detailed returns, which, as usual in the January 1st issue, are to be found elsewhere in these pages.

Reduction in Wages.—Early in the month the Clyde shipbuilding and engineering employers intimated to all the men employed in their works, that immediately after the New Year Holidays they proposed to reduce wages by five per cent on piece rates and one shilling per week on time rates. One month's notice has thus been given of the proposed reduction, and as the men naturally wish to oppose it by all means in their power, conferences have been held at which it was resolved that the proposed reduction was "unjustifiable and uncalled for." A joint deputation from one conference, which was said to represent, by forty delegates, 50,000 workmen, is to wait upon the employers with a view to a withdrawal of the notices. This is the position at the moment of writing, and it is, to say the least, most doubtful whether as a result of this or other deputation the men can make better terms than those suggested by the employers.

New Orient Liners.—The invitations to tender for the new vessels which the Orient Company must build under the new Australian mail contract were sent out about the middle of December, and as the designs of the five vessels were practically ready for the signing of the contract and all the other arrangements connected with the undertaking were also well advanced the fixing of the contracts may shortly be expected. Tenders were to be received by the Orient Company by the end of December, so that little enough time has been given the firms offering to master the intricacies of the specification; as a matter of fact most of the people interested have for a considerable time been pretty well acquainted with the requirements. Naturally, a goodly proportion of the firms invited to tender were Clyde firms. Included in the list were the Fairfield Company, Govan, the London and Glasgow Company, Govan, Barclay, Curle and Co., Whiteinch, John Brown & Co., Clydebank, William Beardmore & Co., Dalmuir, and Scott's Shipbuilding and Engineering Co., Greenock. The firms asked in other districts it is believed are Workman, Clarke & Co., Belfast, Cammell, Laird & Co., Birkenhead, Vickers, Sons & Maxim, Barrow-in-Furness, and Swan, Hunter & Wigham Richardson, Wallsend-on-Tyne. The absence on the list of Harland and Wolff, Belfast, is no doubt explained by the close association of Queen's Island shipyard with the Royal Mail Steam Packet Company. The manner of vessel that is required is fairly well indicated by the terms of the contract. They are to be of 12,000 tons register, faster than the company's existing ships, and therefore more powerful. Their accommodation for passengers is to be in keeping with Orient traditions, which is to say that it will represent work of which not every shipbuilding establishment in the United Kingdom is quite capable. And the insulated space is to be both extensive and in a high degree efficient. Even the dimensions limit the number of possible tenderers for the contracts though the determining factor will not improbably be capacity to turn out the work quickly. The last three vessels which the Company ordered were built at Fairfield, and the one before that at Govan by Robert Napier and Sons, in Dr. Kirk's day. The balance of opinion inclines to favour Fairfield in the matter of these contracts, although it is early yet to speak definitely on the subject.

New Contracts.—While hoped for and rumoured fresh contracts for Clyde builders, such as were referred to in last month's notes, have not come forward, there has not fortunately been the almost absolute absence of fresh contracts such as has pretty nearly been the state of affairs for two months past. The fresh work booked is but the merest tithe of what under average ordinary circumstances is expected. Since December began, a few bookings have taken place of which the following is an enumeration. A contract for an oil tank steamer of 7000 tons carrying capacity has been placed with Greenock & Grangemouth Dockyard Company by foreign owners. Engines for this vessel of 3200 indicated horse-power will be constructed by Messrs. J. G. Kincaid & Co., Greenock, with whom an order has also been placed for the engines of a steamer to be built by Messrs. A. McMillan & Sons, Dumbarton. The Montrose Shipbuilding Company has been successful in securing orders for two large cargo steamers of 500 tons each to be delivered next year. For the Adelaide Steamship Company, the well-known Clyde firm of Alexander Stephen & Son, Linthouse, has contracted to build a steamer 340 feet in length which is likely to embody novelties in her constructional features. In this connection it may be stated that a vessel for the same fleet, now under construction at Kinghorn, is being fitted with Babcock & Wilcox' water-tube boilers. For the Entre Rios Railway, Messrs. A. & J. Inglis, Pointhouse, are to build a railway car ferry steamer, being a repeat of a similar vessel turned out by Messrs. Inglis earlier in the year. The Greenock & Grangemouth Dockyard Company, who have now finished their extensive overhaul—as described in a previous month's notes—of the *Itonus* which, as a cable-laying ship, was known as the *Anglia*, have received an order for an oil-carrying steamer of goodly tonnage. Messrs. Alexander Rodger & Co., Port Glasgow, have contracted to build and engine a steamer of small dimensions, the engines of which will be made by the firm at their engine works at Govan. Messrs. George Brown & Co., Greenock, have received a contract from Italian owners for a twin-screw steamer, 230 ft. in length, for service on the River Plate. The machinery required will be supplied by Messrs. J. and R. Houston, Greenock.

Clyde Trust Repair Works.—The new repair works and slipways which the Clyde Trustees have laid down at Renfrew for the upkeep of their dredgers, barges, ferries and other floating plant are now very nearly completed and are, in fact already partly in operation. The works occupy a site immediately east of Renfrew harbour on ground purchased from Mr. Speir of Elderslie. The area occupied extends to about nine acres most of which has had to be levelled up about 6 feet, the material used for this being from excavations of the new basins and slipways. The north of site fronting

the river extends to 736 feet, and this has all been set back 80 feet so as to widen the Clyde. On this frontage has been constructed a timber wharf 104 feet long by 25 feet wide equipped with a 25 feet derrick crane by Applebys Ltd. carried on piled foundations. On the east end of the river frontage three slipways have been constructed, one over 600 feet long, provided with powerful hauling machinery made by Messrs. William Simons & Co., Ltd. Renfrew, which will be used for the repair of dredgers and hopper barges, and two smaller slips 346 and 280 feet long for dealing with steam ferry boats, punts, etc. The main shops are contained in two blocks of buildings, one being 340 feet by 140 feet containing the engine shop, general stores, boiler shop, and smith's shop, and the other 150 feet by 120 feet embracing the saw mill, joiners' shop, pattern shop, boat builders and carpenters' shops. The equipment of the engine shop, boiler shop and smiths' shop is on the most modern lines, electricity for driving as well as lighting being adopted, the current being supplied by the Clyde Valley Electric Supply Co.'s station on the opposite side of the river. The new shops are replete with machine tools by the best West of Scotland makers, many of them being motor singly driven, others being driven in series from counter shafting. All the lines shafting is fitted with roller bearings. The arrangement of smiths' hearths both as regards blast and the carrying off of the products of combustion is thoroughly up-to-date. Gas-heated furnaces for furnaced work, also gas-firing of the boiler installation are interesting features of the shops. By dredging the Pudzeoch (forming the old Renfrew harbour about two acres in extent), a basin will be formed having an area of about four acres which will provide accommodation for the Trustees' floating plant. A depth of 10 feet below average low water will be provided at the wharves on the north and west frontages. The works will have railway connection on the south with the Glasgow and Renfrew District Railway; rails being already laid round the yard and on to the wharves. All the excavations, embanking, foundations for buildings and machines, piling, wharfing and slips have been carried out by the Clyde Trustees department. The two large buildings were erected under contract by Messrs. Arrol's Bridge and Roof Co., Ltd., now incorporated with Messrs. A. & J. Main & Co., Ltd.

Hastie's Steering Gears.—Messrs. John Hastie & Co., Ltd., Kilblain Engine Works, Greenock, have been very fully employed during 1907, and their recently extended workshops have been taxed to the utmost capacity. Amongst other important contracts completed during the year, were the steam-steering gear for the new Royal yacht *Alexandra*, and for the Imperial Russian cruiser *Rurik*. The steering gear of the *Rurik* possessed many novel features, and in addition to steam and hand-steering gear a complete set of electrical-steering gear was fitted. Steam steering gear was also fitted during the year to new passenger steamers for most of the Glasgow owners, including the Anchor Line, Allan Line, City Line, P. Henderson & Company, Messrs. A. A. Laird & Co., and others. In addition to the vessels for local owners steering gear has been fitted to new steamers for many owners in England and on the Continent. These include vessels which have been built for the Canadian Pacific Railway, Compagnie Générale Transatlantique, Hamburg America Company, Brazilian Lloyds, Lloyd Sabaudo, Prince Line, Shaw Savill & Albion Company, Pacific Steam Navigation Company, Fratelli Cosulich, Trieste, Japanese Imperial State Railways and many others.

Bull's Metal Propellers, etc.—One of the items at present being produced at the works of Bull's Metal and Melloid Co., Ltd., Yoker, is a solid propeller casting in high tensile bronze which will have a finished weight of about 11½ tons, being one of the heaviest solid propeller castings in this material ever made. It will be fitted before the end of the year to the Allan Liner *Pretorian*. A number of other solid propellers of Bull's metal, weighing 10 tons each, have been made and fitted to Atlantic liners during the year, besides a large variety of propellers fitted to vessels up to 19 knots speed. Early in the year the Donaldson liner *Athenia* had a bronze propeller fitted for her original propeller of cast steel, and the engineer's logs show that under practically the same conditions as to draught, but with the expenditure per day of two extra tons of coal of poorer quality, there was an increase in the average speed as compared with a like period with the steel propeller, of .925 or very close upon one knot per hour.

During the year the Bull's Metal Co. have completed a rolling mill for the production of high tensile bronze, phosphor bronze and brass bars of all diameters up to 4 inches, while hexagon bars in the same material will also shortly be produced. For finishing the latter and supplying bar metal to close dimensions, a draw bench has been installed of sufficient calibre to draw bars and tubes up to 4 inches diameter. The mill which has been kept well employed for about four or five months, is, like the foundry section of the works, electrically lighted and driven, there being two cranes of 20-ton capacity each. The current for this installation is supplied by the Clyde Valley Electric Company, whose generating station is close by.

Cross-River Communication.—Increased facilities for cross-river communication within Glasgow harbour, for vehicular traffic especially, have long formed a subject of discussion, if not of concern among Glasgow people, and several schemes in the way of bridges have been canvassed for a time and dropped. Since the closing some months ago of the cross-river tunnel at Finnieston, owned by a private company, the want has been much more acutely brought home than before. Agitation has been in fact active as to the taking over and working of the tunnel by the Corporation or the Clyde Trust. The latter body however look to minimizing the congestion by providing a new vehicular elevating-deck ferry steamer of much greater accommodation than the present vessel, and a new ferry of this type and of great capacity is now well under construction in the works of Messrs. Ferguson Bros, Port Glasgow. Expectations at the moment, are also centred on a scheme for providing not only cross-river communication, but increased quayage within the harbour to be submitted at next meeting of the Clyde Trust by Mr. Mason (of the well-known firm of Morrison & Mason), convener of the Works Committee of the Trust. This scheme, it is understood, involves the construction, near the Finnieston crossing, of "island" wharfage, having bridge spans to north and south of the river and the north span being of the swing or alternatively, of the bascule order of construction. While such a scheme would no doubt greatly relieve general vehicular congestion without being much or any bar to the passage of shipping it is of doubtful utility for the provision of additional north and south facilities for electric tramway lines. The submission in general detail of Mr. Mason's scheme at next Clyde Trust meeting is being awaited with interest.

West of Scotland Iron and Steel.—In responding to the toast of "The Imperial Forces," at the annual dinner of the West of Scotland Iron and Steel Institute, held in Glasgow on December 7th, Rear Admiral Bearcroft said that the complicated machinery which went to the making of a modern man-of-war had increased very considerably the demand for scientific education, but at the same time the science that was required must, when real business was in hand, depend a great deal upon the man behind the gun. Improvement in gunnery had been marked during the last year or two, and he had no hesitation in saying that that improvement was due to the initiative and energy of a very distinguished officer, Sir Percy Scott. The definite decision to proceed with the naval base and dockyard at Rosyth, and the establishment of a torpedo factory at Greenock, and a torpedo testing range in Loch Long all pointed to increased efforts for the efficient working of the forces of the country. In the course of the proceedings at the dinner it was brought out that the Institute showed increasing and continued vitality. Founded in 1889 in its first year it had 169 members, now it had a membership of 427. In 1906 56 new members were enrolled and last year 40 had been added. The Chairman at the dinner, Mr. T. B. Rodginson, referred to tariff and protection questions and said that they were suffering from a depression, especially in the steel trade, that most of the steel works were working "slack" time not at their full capacity, and yet steel and iron goods were being imported from competitors where they were protecting themselves. Replying to the toast of "The University and educational interests of the West of Scotland," Principal MacAlister first paid a high compliment to the department of engineering ably presided over by Professor Archibald Barr, and afterwards referred to the establishment for the first time on an independent footing, of a

lectureship in metallurgic chemistry, which, he said, showed that they in the University realized that scientific foundations were their peculiar business.

THE TYNE.

(*From our Own Correspondent.*)

Proposed Reductions of Wages.—Last month we predicted that the shipbuilders would soon be demanding a reduction of wages, as well as the engineering employers, and the prediction has now received its fulfilment, for a notice of reduction to come in force early in January, has been issued to the employés in all the yards of the North-East Coast. The officials of the Boilermakers' and Ironshipbuilders' Society have made a request that the date of enforcement should be postponed; but the application has not, we understand, been favourably entertained. Indeed we do not know why it should, as the object of the proposed reduction is to relieve present stress and allow the shipbuilders to quote, with some chance of success, for greatly needed work. Shipowners it is well known, are in no particular hurry to place orders just now, freights being still unremunerative; but a few of the more enterprising owners, who have ample capital, might be disposed to order new tonnage if quotations were lowered to a point which in their view would make the investment a tolerably safe one. Nothing but low prices will bring work at this crisis, and no one would benefit so greatly by the placing of a few orders as the men on whose behalf a postponement of the reduction is being asked for. Any orders that may be negotiated when wages have been reduced, will doubtless be of a speculative character, and the placing of them will lessen the force of any sudden demand for tonnage that might arise later. But that would not be an evil as some trade union leaders have alleged—on the contrary, it would be a benefit, as it would materially contribute to the steadiness of trade.

Favouring Foreign Shipbuilding Firms.—On the occasion of the launch of the last vessel on the stocks, at the yard of Messrs. Readhead & Sons, South Shields, which event took place a few week ago, a member of the firm made a statement which since has been much discussed in shipbuilding and commercial circles generally. The statement was to the effect that British steel manufacturers are in the habit of supplying foreign shipbuilders at a rate of fifteen shillings per ton below the price charged to English builders. If this is correct—and no one so far has challenged its accuracy—then it is time something were done to remove so glaring an injustice.

The Shipbuilding Outlook.—Although orders for steamers of a special class have been booked recently by some of the leading firms, it cannot be said that the outlook has in any way improved; nor has the amount of work in hand at the majority of yards shown the least tendency to increase. Rather the reverse state of matters is to be noted, for vessels have been launched that have not been succeeded by others on the stocks. Foreign competition is now a factor to be taken seriously into account, and as it is essential that England should continue to hold a commanding lead in shipbuilding; every aid which might help towards that object, should be unhesitatingly adopted. Notwithstanding trade union opposition, labour-saving appliances should be brought into use wherever possible and unskilled labour should be utilised in the working of them. In this way economies of time and money could be effected, and production cheapened to an extent which would enable English builders to compete successfully in the matter of price with their foreign rivals. As compared with former slack periods, the quantity of tonnage "laid up" in the Tyne is surprisingly small, and that is about the only encouraging feature in the situation. Owners have probably discovered that "laying up" is even a more expensive process than running vessels at a loss, and they are doubtless acting on the principle of choosing the lesser of two evils. Freights are so low indeed, that it may be taken for granted, that there is not much to be made at this juncture, in the running of steamers. Messrs. Swan, Hunter & Wigham Richardson, Ltd., are credited with the acquisition of two important orders, and Messrs. Armstrong, Whitworth & Co., are also said to have secured contracts lately. Messrs. Dobson have also added to their prospective work engagements, and Messrs. Wood, Skinner & Co. who have lately launched a handsomely designed vessel for Newcastle owners, have their building berths still fully occupied.

Repair Work.—Messrs. Robert Stephenson & Co. have just completed an exceptionally important repair to the Atlantic liner *Finland*, which involved the removal of the bow portion of the vessel, that had been considerably damaged, and the new structure in its place. This is said to have been the fitting of a largest vessel that has ever been docked on the Tyne. Messrs. Stephenson's dock is now occupied by another large vessel, and it is not likely to have many intervals of vacancy this winter. It is stated that the large liner *Norseman*, is coming to the Tyne to receive a general overhaul. Messrs. Readhead and Sons have launched the only vessel on the stocks; but it is understood that another is to be put down. One vessel, however, is not much for a yard in which four—being built simultaneously—has usually been the minimum.

The Engineering Industry.—At Messrs. Parsons' works, Wallsend, an ocean-going torpedo destroyer, the *Afridi*, has just been fitted with turbine engines, and will immediately enter upon her trials. The vessel is fitted with an arrangement for heating the boilers with liquid fuel, when expedient. There is not much change to note in the state of work at other marine engineering establishments, all of which are, if anything, showing less activity than was apparent a month ago. Manufacturers of auxiliary machinery and deck accessories generally, are keenly experiencing the effects of depression, and it is feared that the slack period, which has set in, will be a protracted one. The wages question has not yet been settled, and there is a feeling abroad that the employers will accept a smaller reduction than was originally asked for. The employers are no doubt averse—as they always have been—to entering upon a contest with their workmen; but it is certain that they could enforce the full reduction if they cared to do so, and if for the sake of peace they refrain from exerting their full power, the circumstance will be greatly to their credit.

THE WEAR.

(*From our Own Correspondent.*)

The Shipbuilding Trade.—A look round the Wear yards will not at present afford much satisfaction to anyone interested in the prosperity of the port. Some of the principal yards, which for years have not shown an empty berth, excepting for the day or two succeeding a launch, are now very bare of work. One yard, certainly, which had been inoperative, has started again, and even for this scant meed of betterness, we must be thankful. At the North Hylton yard business is still quite active all the berths being filled. Messrs. S. P. Austin & Sons have launched the last vessel on their stocks, and it is feared that this berth, as well as the others, will remain empty for some time. The firm, however, have some good repair contracts, and this department is at the moment busy. The locally-owned steamer *Wharfedale* is on the pontoon dock, receiving extensive repairs, and the S.S. *Wallsend*, which has been in collision with the S.S. *Monmouthshire*, at Antwerp, has just been placed in the graving dock for repairs and general overhaul.

Messrs. Robert Thompson & Sons, of the Bridge Dockyard, have been busy during the greater part of the year, and have just completed an important general repair on a locally-owned steamer. The firm have just secured an important contract to carry out an extensive bottom repair to the S.S. *White Sea*, which has been ashore in the Sound. The vessel is to be placed in the Wear Commissioners' No. 1 graving dock, and it is estimated that the work will give employment to 300 men for at least a month. It is expected that the firm will have their Bridge Dock regularly occupied for some time to come with vessels to undergo repairs, many of which are of foreign ownership.

The Engineering Trade.—The North Eastern Marine Works are still busy, and the Scotia Works (Messrs. Richardsons, Westgarth & Co.'s), have work enough to last (without further additions), till August. At the other more important works, slackness is plainly visible. One small engine works adjoining the Lambton coal shipping staithes is advertised for sale "as a going concern." Foundry work is exceedingly slack and quite two thirds of the resident moulders are receiving "idle" benefit or "home donation" from their society. Electrical works at Pallion are keeping well employed.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

THERE has been a steady increase in the Ship Canal traffic every year. In 1894 the railway work was only valued at £84,000. Last year it was £1,457,000. In 1894 the toll paid was on 686,000 tons; in 1906 toll was paid on 4,441,241 tons. The figures for the present year are known to exceed those of last year. The total weight of imported articles in 1906 was 2,489,000 tons, and the exports 1,951,326 tons. The imports were largely grain and timber, and of the exports 1,082,000 tons were coal.

In reply to an appeal from the Manchester Chamber of Commerce, the Colonial Office has intimated that steps have been taken to secure the earlier transmission to this country of all Colonial Bills affecting commercial interests, and these will be published in the Board of Trade journal as soon as received.

The receipts of the river Weaver Trust for the official year just closed amounted to £49,000. Over a million tons of goods were carried. This showed a profit of more than £3500 compared with the previous year, arising mainly out of the carriage of an additional quantity of chemicals by 25,000 tons. For the reconstruction of the Anderton Lift £20,000 has been borrowed. It is estimated that about 190,000 tons now pass over the lift every year. The reconstruction is to be completed by Easter.

Extraordinary records of exports of textile machinery continue to be filed. The shipments in November were valued at £714,578 against £611,421 for November, 1906, and £546,000 in November, 1905. From January 1st to Nov. 30, the total was £7,344,733, as against £6,079,301 for the corresponding period last year, and £5,042,404 for the first eleven months of 1905. The exports this year have been despatched to practically every country under the sun. The largest consignments have been sent to British India, Germany, France, Japan and the United States. Although the iron textile trade is so busy, and notwithstanding that workmen's wages have been raised voluntarily in Ashton-under-Lyne and in other parts of the county 2½ per cent., other branches of the iron manufacturing trade are wanting orders. The prices of crude metal, like those of copper, tin and lead, have been gradually decreasing for some time past. The new year does not open with the brightest prospects in machinery requirements, but the future is a sealed book, which the wisest of mankind cannot open.

The importation of American cotton to Manchester direct in 1906 was 458,123 bales, being an increase of 118,000 bales. Of Egyptian cotton the total was 220,864 bales against 212,257 bales in the preceding season. Still more cotton should come to Cottonopolis by the canal, but why it does not is an enigma, for direct shipment represents a saving. The only explanation is that the cotton trade has been so very prosperous latterly that economy is at a discount. Experts state that it is a fair estimate to put the available supply of American cotton this season at over eleven millions of bales.

An inquiry is to be made by the Royal Commission on Canals and Waterways into the probable cost of improving the canals and waterways connecting the Midlands with the Thames and the Humber, and with the Mersey and the Severn.

The coal trade of the county Palatine is in a most prosperous condition. Lord James of Hereford, the umpire of the Coal Conciliation Board, has just given his decision in favour of the maximum rate of wages to be paid to miners of the Federation fixed according to the terms of the last agreement, which increase is to take effect from the beginning of 1908. The next step by the operatives is to get the minimum raised in the scale of the agreement. Prices of coal at the pits remain as fixed in September, but what with an increase of the fourth rise of 5 per cent. within twelve months and the increased railway carriage, another rise in coal prices may be looked for. In the Wigan colliery district 6d. per ton advance is being charged for all classes of steam coal. The total production of coal in the United Kingdom during 1906 was 251,068,000 tons. In France, owing undoubtedly to the disastrous labour strike in the northern coalfields in the early part of the year, the output showed a decline of nearly a million tons. The total quantity of coal exported during the first nine months of the present year was 46,884,000 tons, as compared with 41,230,000 tons during the corresponding period of 1906.

A new method of indicating the power of a turbine has been devised by Mr. Bevis and Mr. John Gardner, of Fleetwood. Two commutators, both alike, and having a large number of segments, are fixed to the shaft at some distance apart axially, and a current from a low voltage cell is fed into the shaft at a brush contact, and leaves again by way of both commutators, completing the circuit through a dead heat ammeter. Each commutator interrupts the current flowing through it as the shaft revolves. The currents form the two commutators, combine on leaving the shaft, and give an interrupted current, the relative periods of current and no-current depending upon the relative angular positions of the commutators, and therefore by the twist in the shaft. The dead-heat ammeter measures the effective mean value of this interrupted current, and therefore gives a means of measuring the twist in the shaft and the power it is transmitting.

THAMES.

(*From our Own Correspondent.*)

The Port of London Scheme.—As the time draws near for the meeting of Parliament, naturally more is heard of this project and the matter is beginning somewhat to shape itself. The interest taken in the matter is large commensurate with the degree of importance involved and the many interests touched. The trade of the port is easily the largest in the world, the value being 285 millions, while the tonnage for 1906 was 1,278,000 in excess of that for 1905. But while the Thames has increased other ports on the Continent have increased in a greater ratio. This is what causes the disquietude and the need for a central authority in the way of a Port Commission. What is not disclosed as yet is as to its composition. There is the finding the necessary money and the right class of member to rule the new body. The question is therefore complicated, but it seems to be thought that the President of the Board of Trade is the right sort of man to deal with the problem. It appears to be settled that the functions of the Thames Conservancy below Teddington shall be taken over, and the property of the Watermen's Co., Port stock being issued that shall rank as a trustee security, and be guaranteed by the London County Council. The Commission will not only levy dues upon tonnage but also upon goods which as barge and lighter business now comes in free must necessarily interfere with this. The crucial point is as to the relations of the Commission to the Dock Companies and Wharfingers. Together these bodies are answerable for forty millions of capital. As far as can be gathered a free hand is to be given, that is, with the capital acquired the new body is to be at liberty to take over the docks or build new ones. It will thus be seen, now the matter is somewhat clear for the first time, that we have before us a situation fraught with great possibilities of disagreement between the new and the old masters. One thing that has been made clear up to the present is that it is not more expensive docks that are needed, but wharfage or stagings in the river where ships can load or unload cheaply, and if new legislation recognises this need which it will be observed is not so expensive as more docks, then the coming changes will be in the right direction.

The New Thames Dredger.—This vessel, which we have previously commented upon, is said to have arrived in the river. She is named the *Lord Desborough*, in compliment to the Chairman of the Conservancy. She will work in the estuary of the Thames to make a channel 1000 ft. wide and 30 ft. deep.

The P. & O. Co.'s Report.—The chairman had a very encouraging statement to make at the meeting recently. In addition to the dividend of nine per cent over the amount of the paid up stock, £460,000 was set aside for depreciation. A great deal of the trade at this end is done with the Continent, and the remark was made confirming what we have said above that in any settlement of the Port of London question what is wanted is a cheapening of dues for trade to be furthered. It was mentioned that the settlement of

the mail contract for the next seven years put the Company in a favourable position. Truly the statement does credit to those concerned.

L.C.C. Steamboats.—The report for the year has been recently published and shows a loss on the working of £18,416, which, together with the interest and debt charges brings the total for the year up to £40,373. This summer having been so bad it is anticipated the loss will be greater still. What has been decided up to the present is to discontinue the service of Chelsea, above which there has been less use of the boats than elsewhere. For this season it is proposed to reduce the fleet to twenty-four vessels, thus getting rid of six of the present ones. Further recommendations are anticipated in the New Year.

Blackfriars Bridge Accident.—In circumstances that are happily rare the lowering of one of the caissons into place for widening this bridge resulted in a serious catastrophe and loss of life. Three similar caissons had already been lowered safely, and at the time of the accident this one was about eighteen feet below the level of the staging with its lower edge just touching the water. The evidence went to show that the accident was due to the collapse of the bearing girders, upon which the caisson hung, due it is supposed to uneven lowering, this being the concensus of opinion of the expert evidence adduced before the Coroner.

Yacht Racing Association.—This body held a meeting recently in London to consider the adoption of the rules of the International Yacht Racing Union, which comprises all the nations of Europe. As a result the rules were adopted without any dissentients and were accordingly confirmed.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—The position of the North-west of England shipbuilding trade is practically the same as last month, with the exception that it seems more probable to-day than in October that new orders will soon be booked by the great Barrow firm. It is generally known throughout the trade that Vickers, Sons & Maxim sent in the lowest tender to the Admiralty for the construction of the battleship *H.M.S. Rodney*. Indeed, it was evident the Vickers' firm intended securing this order, as their price was very much below that of any other tenderer. The fact is that Barrow was short of work, that the firm by its resources is capable of taking orders more cheaply than many of the other firms who sent in tenders, and, of course, there was the natural desire to build one of the new *Dreadnoughts*. The news that Barrow was the lowest in price for the *Rodney* was welcomed in Barrow, as for some considerable time past the naval construction works have been short of orders, and have not afforded employment for more than half the number of hands they are capable of finding work for. At the yard at Barrow four or five *Dreadnoughts* could be put down at one time. But, of course, at the time of writing the Admiralty have not placed the order for the *Rodney*. Several formalities have yet to be gone through, but it seems more than probable that the order will come to Barrow, as some regard must be paid to the fact that Barrow's is the lowest tender. There is the further fact that although at Barrow some very worthy additions have been made to His Majesty's fleet, there has been no large order placed there since that of the battleship *Dominion*, which has been in commission for some years. On the face of it, it is Barrow's turn for work of this class, and especially so seeing the price is right.

A Fly in the Amber.—But there is a fly in the amber. A section of the Labour party in the country are reported to have brought influence to bear on the Admiralty to secure the order for the new battleship for Jarrow at Barrow's price, in consequence of the great inactivity that prevails in shipbuilding on the north-east coast. This, to say the least of it, is a novel proceeding which will probably be resented by the Admiralty. On the other hand, it is fair to say of the Palmers' firm that this movement has not been initiated by them, and in all probability has not their approval. To ask a firm to build a warship at £80,000 less than the price they sent in to the Admiralty is a big contract, and it may be taken for granted that the Tyneside firm would do no such thing. At any rate, it shows the trend of feeling in the Labour party, and demonstrates their desire to control the distribution of orders on a basis which has no commercial foundation, and which if carried into effect would upset business in a way which would do more harm than good. Generally speaking, the experience of shipbuilders is that the lowest tender is accepted, providing the firm which puts that tender in is reputable and well qualified to undertake the work. There can be no possible question as to the Vickers' firm's capacity to do the work. This is a question which affects all builders alike who would all doubtless resent the interference of the Labour party as to the distribution of work. If work is slack on the East Coast and busy on the Clyde or at Barrow men move from one place to the other, and this is a practice which is sure to continue. Furthermore, Mr. Pete Curran, M.P. for Jarrow, is a Labour representative, and so also is Mr. C. Duncan, M.P. for Barrow. The transfer of this prospective order for Barrow to Jarrow through Labour influences would mean certainly the loss of a seat for Labour at Barrow. The whole proposal is too absurd to be seriously considered.

The Spanish Navy.—There are other orders which it is hoped will be secured for the Barrow yard, about which more anon. The demand for new tonnage is not, however, very large, and especially is this the fact as regards high-class commercial tonnage, and yet the Orient Line are in the market for some large steamers, and it is believed the Canadian Pacific Company will soon place new fast steamers on the Atlantic. There are some hopes at Barrow that part of the order for the new Spanish fleet will be placed here. It is understood that Messrs. Beardmore, of Dalmuir, have booked the contract for the £7,000,000 worth of new ships required by Spain. This is more than any one firm in the country would possibly deal with, and as the Vickers' firm are half proprietors of the Beardmore firm it seems more than likely they will be specified as part builders of the ships. There has been some talk that after all Spain would not incur so heavy an expenditure, but the proposals of the Government have already been approved by the Cortes, and the arrangements have been completed as regards the money required. It seems, therefore, highly probable that the order for the ships required will soon be placed, if it has not already been placed. The Spanish Admiralty is known to have been advised what class of ships to build by the British Admiralty. This shows a friendly international feeling, and especially when an up-to-date Power like Great Britain shows its willingness to give expert advice to an old-world Power which has had bad luck in recent years, but whose Atlantic shores Great Britain and France have mutually agreed to assist her in protecting.

The Russian Cruiser "Rurik."—It was anticipated that the Russian armoured cruiser *Rurik* would have been so far completed as to enable her to leave Barrow for the Baltic on the 7th December, but it was ultimately decided to delay her departure until early in January, in order that absolutely the best finish could be given to the job. There can be no question that the *Rurik*, when completed, will be one of the most perfect up-to-date specimens of warship construction turned out of any yard in the world. She has been under remarkably efficient inspection, and the builders have been anxious to show to the Russian Admiralty what a British-built fighting ship is like. There are proposals, which it is understood are practically completed, whereby the new Russian Navy shall be built in Russian shipyards, and the firm of Vickers, Sons & Maxim have agreed to make the plans for several ships and give expert advice as to their construction for a price of £400,000 with given guarantees as to speed. This is a novel departure but one which should work out admirably for the shareholders of the Vickers' firm. It is not thought probable any more Russian ships will be built in this country, but as Russia is not at present in a position to build all the ships she requires, it is yet possible that the Barrow firm will, in the end get commissions to build further ships at their shipyard in North Lancashire.

British Capital for Japan.—An interesting agreement has been made between Vickers, Sons & Maxim and Armstrong, Whitworth & Co. on the one part, and a Japanese shipbuilding firm on the other, whereby British capital is to be introduced into this Japanese firm with a view of laying it out on a large scale for the building of warships, engines,

armour, guns, etc., the two British firms allowing the use of all their patents for use in the Far East. The combination shows a remarkable development of British interests, and also shows a determination of the two leading British firms in shipbuilding construction to bid for a share of the work in the Far East. Japan by this means gets the help and advice of the most expert men connected with warship construction in the world. This is not the only instance in which these firms have combined for mutual interest, and it shows the trend of events in the direction of the grouping of capital. Other developments may be expected to arise in the future by which great concerns will seek to protect their interests by a common understanding or by combination.

Launch.—During December Vickers, Sons & Maxim launched the second cargo steamer for the London and North-Western Railway Company, the *Slieve Gallion*, which is a sister ship to the *Slieve Bloom* launched in the previous month, a description of which appeared in the last issue of the *Marine Engineer*. A third steamer to carry passengers and cargo has yet to be launched for the same owners. The Mexican transport steamer building at Barrow will probably be launched in January, and soon afterwards the Isle of Man Steam Packet Co.'s 25-knot turbine steamer will be launched. Later on the Brazilian *Dreadnought* will be launched.

A Remarkable Steamer.—Vickers, Sons & Maxim are building a steamer for the unique purpose of carrying submarine and other craft to foreign ports. The vessel, when launched, will in the first instance carry to Japan the two submarine vessels now building at Barrow. The steamer is so constructed that she can be used if need be to carry ordinary cargo, so that she can be employed in this way when not wanted for the special purpose for which she is being built.

The Year's Shipbuilding. — The shipbuilding tonnage built at Barrow during the year shows a much lower return than usual, as no large vessels have been launched. The total tonnage put into the water amounted to 4882 tons, and the indicated horse power of the engines built to 15,150.

West Cumberland.—A fairly steady but small class of shipbuilding trade is being done in West Cumberland. The tonnage built at Workington during the year totalled at 1089 tons, while at Maryport the shipping built aggregated at 518 tons, and the indicated horse power of the engines built at 900.

Shipbuilding Material.—There has been a quiet demand for shipbuilding material during the month, but the plate mills at Barrow have been fairly busy, and there are hopes of a continuance of activity. Heavy plates are at £7 5s. net cash. A fairly good business is being done in heavy steel castings for shipbuilding and engineering purposes.

Hæmatites.—There is a very small demand for hæmatite iron, and prices have fallen to 67s. 6d. net cash warrant sellers, and 68s. for mixed Bessemer Nos. net f.o.b. Stocks of iron have been further reduced, and now stand at 5639 tons.

Shipping.—Shipping returns show a shrinkage. The total exports of pig iron and steel this year to date have reached 805,257 tons, compared with 780,695 tons in the corresponding period of last year, an increase of 24,562 tons.

HARTLEPOOLS.

(*From our Own Correspondent.*)

Docks.—The North-Eastern Railway Co., who are the proprietors of the several docks, through their directors, are going to give orders to have the docks, or at least part of them, made up to the latest requirements. They find this port, whilst good for old time wooden ships, to be sadly out of date for the large ships with their respective enormous beams. The proposal is to remove the Fish Quay now lying between the townships of West Hartlepool and Hartlepool, and bring it nearer to the latter town and in close proximity to the station. It is expected when it becomes an established fact that it will give a great fillip to the fish trade, also the removal of the present Quay will allow for the extension to the entrance of the docks, which is now far too small for ships over 56 ft. in beam.

Engineering.—Messrs. Richardsons, Westgarth & Co. are completing the three sets of inverted direct-acting triple-expansion surface-condensing engines of about 3,000 I.H.P. for the Hamburg-American Line for their West Indian trade. The cylinders have a diameter of 25½ in. by 43 in. by 72 in., and 48 in. stroke with three boilers 14 ft. by 12 ft., and the first ship when completed, which will be early next year, will be able to produce a speed over twelve knots. The engine-rooms of these ships are being fitted up with the usual high-class auxiliaries, such as Howden's forced draught system for the boilers, Weir's feed pumps and heater, Weise and Monski ballast pumps and general purpose pump, also sanitary and fresh water pumps, Hall's refrigerator plant, Furness Withy & Co.'s electric light engines and dynamos. The steam is brought separately from each boiler to the engine by pipes made of Siemens Martin steel, with Morison's universal expansion joints. The engines and all machinery have been built under the supervision of Herr Wilke. They have also booked a set of engines 24 in. by 39 in. by 66 in. by 45 in. stroke, for a ship being built by Messrs. the Blyth Shipbuilding Co., Blyth, to the order of Messrs Huddart Parker Proprietary, Australia.

Shipbuilding.—Everybody is aware there is a slump in the shipbuilding trade, and locally we are no better than other districts. Messrs. Gray's yard has seven empty berths out of eleven, Messrs. Irvine's yard is full, but the tonnage is small. Messrs. Furness, Withy & Co. have two of the three berths empty. Several of the firms are having fourteen days holiday this year. It is regrettable, for it shows that there is no demand for new tonnage. The high price of coal which seems to be becoming higher, tends to keep shipbuilding speculation practically dormant.

SOUTHAMPTON.

(*From our Own Correspondent.*)

The White Star Liner "Suevic."—Work is progressing rapidly on this vessel, and both sides are now completely plated and most of the plates are riveted, and every endeavour is being made to have the vessel ready to take up her advertised sailing about the end of this month.

Messrs. Harland & Wolff's shipbuilding and repairing shops are now rapidly approaching completion. The foundations are being prepared for the various machine tools which are constantly arriving, and the glazing and painting work are in an advanced state. The premises occupy two and a half acres of ground, and when completed will be able to undertake repair work of all descriptions in a very expeditious manner.

The New Dock.—The site of the new dock is now enclosed within a high fencing, and the contractors' men are busy laying the various railway tracks necessary for the construction of the dock. Several grabs are at work on the river Test side and the preparatory work on the site is progressing rapidly.

Messrs. John I. Thornycroft & Co., Ltd., launched on Saturday, Dec. 7th, the first-class torpedo boat No. 19 from their Woolston Yard, the vessel having all machinery and boilers on board. The vessel is one of the new 26-knot torpedo boats (late Insect class). The machinery consists of Parson's turbines, which are capable of developing about 4000 I.H.P., Steam is generated in two "Thornycroft" water-tube boilers. The hull and machinery have been constructed at the Woolston Works, whilst the boilers were constructed at the firm's Chiswick Works. Messrs. Thornycroft built five similar vessels for the British Admiralty for the last naval programme, and three further vessels of the same class are now under construction at Woolston Works.

"Tartar."—This new turbine torpedo boat destroyer (built and engined by Messrs. Thornycroft at Woolston Works) carried out a most successful official preliminary trial in the neighbourhood of the Maplin Sands on Dec. 6th. The speed actually obtained was 34·857 knots per hour, the vessel having a greater load than that stipulated by contract. This speed was a mean of six runs on the Admiralty measured course, and the result exceeds by nearly half a knot the speed obtained by any other vessel of this

class. The greatest speed attained by this vessel was 35·952 knots per hour as a mean of runs with and against the tide over the Admiralty course, and was obtained after the vessel had run from Southampton to the Maplins at an average speed of 34 knots. The *Tartar* has thus broken all records, and Messrs. Thornycroft are to be congratulated on this splendid achievement. The Admiralty officials present included Mr. J. H. Ball, Mr. H. G. White and Commander Frowd, R.N. There were also present Colonel Russo and Major Girola, of the Italian Navy, and Lieut. Cassel of the Swedish Navy. Since undergoing the trials on the 6th December, the *Tartar* underwent further trials on the 16th, when she established a world's record. The speed obtained on the six runs on the measured mile was 35·672 knots, and that maintained during the six hours run was 35·363 knots. The quantity of oil consumed was well within the guaranteed amount, and the Parsons turbines worked without a hitch of any kind. The *Tartar's* splendid record is much better than that of any of the three other ocean-going destroyers of the *Tribe* class, as is evident from the following table.

	Six runs on measured mile.	Six hours speed.	Fastest speed on an individual mile.
Cossack	33·15	33·1	33·65
Ghurka	34	33·91	—
Mohawk	34·51	34·245	35·294
Tartar	35·678	35·363	37·037

The greatest speed attained by the *Tartar*, *i.e.*, 37·037 knots per hour is equivalent to 44 miles per hour, which is approaching the speed of an express train. From a perusal of the above table it will be seen what a splendid result has been obtained, and Messrs. Thornycroft are to be congratulated on this brilliant achievement. The "Tartar" was coated on the bottom with Holzapfel's Antifouling Composition.

The Red Star Liner "Kroonland," outward bound from Antwerp to New York, put back for Southampton, having broken one of her propeller shafts on the 9th December during a very severe gale. After leaving Antwerp extremely rough weather was experienced, which steadily increased in force on the trip down Channel, and when the accident occurred the vessel was off the Bishop's Light, west of the Lizards. The vessel was then headed for Southampton, making about 10 knots. On arrival the vessel was dry-docked and a new shaft fitted. The passengers were transferred to the White Star liner *Majestic*, which sailed on the 11th December.

Messrs. Day, Summers & Co., Ltd., of Northam Ironworks, are building a large steam yacht of the following dimensions :—190 ft. 9 in. by 29 ft. 7 in. by 16 ft. 10 in., to be classed 100 A 1 at Lloyd's. The yacht has been designed by Messrs. Camper & Nicholsons, Ltd., of Gosport, and is of 750 tons B.M. The machinery comprises a triple expansion engine having cylinders 18 in. by 30 in. by 48 in., with a stroke of 30 in., and there are two single-ended return-tube boilers, each 13 ft. 3 in. dia. by 11 ft. long to work at a pressure of 180 lbs. per square inch. The vessel is now well advanced and a very large amount of work has been done since the contract was signed. The rudder forging, it may be mentioned, is amongst the largest forgings turned out in Southampton in recent years. All the principal engine castings and forgings, with the exception of the shafting, have been made by Messrs. Day, Summers, and in the case of the shafting it was decided to purchase it from an outside firm in order to expedite delivery of the vessel.

BELFAST.

(From our Own Correspondent.)

The Past Year, and Prospects.—Belfast shipbuilders have every reason to be satisfied with their output of tonnage for the year, especially in view of the fact that the progress of operations was from time to time materially affected by a succession of labour troubles. Several notable vessels have been launched, amongst which may be mentioned the Royal Mail Steam Packet Company's twin-screw mail and passenger steamers *Avon* and *Asturias*; the new bow portion of the White Star Liner *Suevic*; and a whole fleet of first-class passenger steamers for the Lloyd Brazileiro. As regards repair work, the report made this time last year must unfortunately be repeated for 1907, and for the same reason. Owing to the temporary lack of graving dock accommodation few ship repair jobs of an extensive nature have been carried out. During all this period the only docks available were the two Clarendon and the Hamilton graving docks; the former only large enough for coasters, and the latter for vessels not exceeding 470 feet in length. The contractors, however, arranged to have the repairs to the Alexandra Dock completed by the end of the year, and it is highly satisfactory to note that their promise has been fulfilled, the dock being now ready for occupation. It is not at all likely to remain long vacant. The prospects for the next twelve months are good, the yards are at the present time fully occupied, and there is a sufficiency of orders in hand to justify the prediction of a prosperous New Year.

Messrs. Harland & Wolff.—Important developments have been in progress for some time past at the Queen's Island. Several new buildings have been put up, and others are in course of erection. A large and fully equipped establishment has been built for the manufacture of bolts and nuts; and an additional platers' shed nearly 600 feet long has also been erected. Then, slips have been lengthened in preparation for the construction of the mammoth White Star and Hamburg-American liners. Rapid progress has been made with the erection of the new floating 150 tons crane referred to in last month's notes. On the 5th of December Messrs. Harland & Wolff launched a steamer of about 6,500 tons, named *Median*, for the Leyland line. A sister-ship for the same owners will be put in the water early in the year. Before these notes are in print they will have launched the Aberdeen liner *Pericles*; and the Royal Mail Steam Packet Company's *Asturias*, referred to above will have been completed and sailed.

Messrs. Workman, Clark & Co.—This firm is reported to have secured the contract to build a passenger steamer of 8,000 tons, for the Shaw, Savill and Albion Company's Colonial trade. On the 27th of November they completed and sent on trial the steamer *Kia Ora*, built and engined by them for the same owners. She is 464 feet in length, with a gross tonnage of about 6,560. The propelling machinery consists of two sets of triple-expansion engines, steam being supplied by five single-ended boilers, fitted with Howden's forced draught system. While these notes are being penned the Lamport & Holt liner *Verdi* is undergoing trials down the Lough. The *Verdi* is 445 feet long, with a gross tonnage of 6,300, and has been built by Messrs. Workman, Clark & Company, for the owners' South American passenger and cargo trade. Fruit-carrying steamers are a class of vessel in the building of which Messrs. Workman, Clark and Company have come rapidly to the front. On the 5th of December they added to the number by the launch of the first of the two they have on order for Royal West Indian Mail Company, of Amsterdam. The new vessel is named *Coppename*, and has been specially designed for the West Indian trade. She is 352 feet long, and has a gross tonnage of about 3,500.

Strike Settlements.—The two strikes referred to last month, namely those of the patternmakers, and of the coal dischargers, have since been settled. The patternmakers demanded an immediate advance of a shilling in the week's pay; but a compromise was arrived at, the men agreeing to the increase being made in the first pay in March next. This will bring their wages up to forty shillings, a rate of pay which can leave no room for grumbling. As regards the coal men, the trouble with them "fizzled out," chiefly owing to a lack of funds with which to carry on their fight. The position they took up was, however, quite untenable. Little difficulty was experienced in finding men to take their places, and numbers of those who went out have not yet succeeded in getting re-employed. The Harbour cranemen, who, as a body, threw in their lot with the strikers, are now suffering the penalty of their folly. They were distinctly warned that their action would result in their being displaced by other men of whom there were numbers ready and willing to be taken on. They blindly disregarded all advice; and later, when they saw that the warnings were no mere idle threats, came cap in hand to beg for reinstatement. Their request was, however, firmly refused,

and the men have only themselves to blame for the awkward position they now find themselves in.

Harbour Items.—As above stated, the Alexandra Graving Dock is now available for the dry-docking of vessels. The Harbour Commissioners are at present inviting tenders for the construction of the Queen's Road electric tramway. This tramway will serve the shipyards, engine works, and the large graving docks.

JUNIOR ENGINEERS.

XVI.*

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Smithing *(continued).*

DURING the manufacture of any forging, particularly steel, the heating, working and cooling set up internal stresses which considerably impair the strength of the material, the arrangement of the particles is disturbed and must be brought back to the normal condition by annealing. The forging is placed in the annealing furnace and gradually brought to an orange red heat, about 1000°F., and kept at this temperature for some hours, according to the size of the article, until the heat has thoroughly soaked through to its core, the forging being then withdrawn and allowed to cool unexposed to cold air or water. The effect of annealing is to soften the material, making it tougher and more ductile and eliminating brittleness. All steel forgings, especially those that are drop-forged from dies, are annealed, and with light, accurate parts precautions are necessarily taken to ensure that no distortion of form takes place.

Dies or tools made from high-grade steel, which require to be hardened, must be protected in some manner from the oxidizing action of the air and flame to prevent the surface carbon being removed and thus destroying its hardening qualities. This is done in various ways, one of the most usual being to enclose the articles in an air-tight box all packed in with granulated charcoal, the whole is placed in the furnace and, after thoroughly heating, is allowed to slowly cool before breaking the seal. Other successful methods have been adopted such as enclosing in an atmosphere of coal or other gas rich in carbon, and heating thus so as to exclude air.

Where only a few small parts are required to be annealed, a simple process very often adopted is to heat the article in the fire to an orange red and then plunge it into a box of granulated charcoal or lime to cool.

The manufacture of malleable castings is allied to the annealing process, and where only a few are occasionally required they are frequently finished off in the smithy. The iron best adapted to the purpose is a white iron low in silicon and phosphorus and high in carbon; the castings from the foundry are packed in an air-tight box with black iron oxide—the scale from rolling mills or the forging hammer—and moistened with water, or a rusting agent such as sal-ammoniac, to supply oxygen. The box is placed in the furnace and heating continued for hours or days at about 1800°F., a white heat and almost the melting point, till the castings are thoroughly softened, the combined carbon in the cast iron being oxidized out, leaving the material almost pure iron and therefore malleable. After cooling, the castings will be found to have expanded and frequently distortion takes place; the former is allowed for in making the pattern and the latter is remedied by forcing into shape by means of dies or simply under the hammer.

Casehardening of wrought iron and mild steel is often resorted to when it is required to harden the surface to resist wear and still retain the strength of the tough core. The articles, after having been machined, are packed in air-tight cast-iron box with charred leather, bone dust, or other similar material rich in carbon, and subjected to a red heat for some hours, depending on the depth of case required, they are then removed and plunged into cold water. Another method is to heat to an orange heat and then plunge the article in solid potassium cyanide, quenching in water as before. Fused potassium cyanide and the ferrocyanide are also used, alone or as mixtures with salt, sal-ammoniac or camphor, the article being heated in a crucible of the hot liquid and then quenched in water.

When a piece of steel is heated and suddenly cooled it is made hard and brittle, and in order to fit it for use as a cutting tool some of this hardness must be sacrificed to obtain sufficient toughness to withstand the stress put upon it, and it is therefore necessary to temper it, this being in effect an annealing process. The usual method of tempering a cold chisel is to heat an inch or so at the cutting end to a medium orange, about 1200°F., quench the tip in water, brighten the cooled surface by rubbing with a piece of brick, and wait till a dark purple colour appears, then thoroughly quench the whole tool in water. The first cooling of the tip hardens it, the heat remaining in the body of the tool then gradually extends down and produces the colours which indicate the point at which to quench for the necessary hardness, combined with toughness for resisting impact. The colours which appear, as the cooled portion gradually becomes warmer, range from yellow at about 430°F., through straw and brown yellow, purple, light and dark, to blue in various shades at about 600°F., finally glowing at a dull red heat at about 700°F. Considerable latitude exists between the exact quenching points as denoted by the colours, depending on the carbon content of the steel, and the treatment of the various grades experience alone can decide. The usual amount of carbon present in ordinary chisel steel is about 1 per cent., this being the most useful all-round grade, and from 1·5 to 2 per cent. for lathe tools, the tempering colours ranging from the yellows for drills and scrapers to the purple blue for chisels; the greater the impact to which the tool is subjected the more heat must be let into the tip before quenching, thus a chisel for a light finishing cut on brass can be left harder than a tool for a heavy cut on cast iron.

On account of the uncertainty of the tempering by colour process other methods have of necessity been adopted, particularly in factories specializing in tools, instruments and small articles. For hardening, a charcoal fire is the most suitable to prevent the oxidation of the carbon, and the steel is quenched immediately upon withdrawal from the fire. Various baths are used both for hardening and tempering, such as melted lead, hot oil, air and sand, the heat being accurately gauged by thermometer. In drawing the temper the previously hardened steel is immersed in the molten lead or hot oil till heated to the bath temperature, it is then removed and quenched, the temperature for a given temper being previously determined. It is impossible for the tool to be drawn more than necessary, provided a uniform heat is maintained.

Gas furnaces and muffles are largely used, as the temperature is under complete control, and both hardening and tempering are completed by air-heating, the steel being protected from the direct action of the flame.

Cold oil is frequently used for quenching, also brine, and various tempering solutions are compounded of nitre, salt and sal-ammoniac, the heating being not over cherry red for these last.

Milling cutters are often finished at one heat by first quenching to cool the teeth and then allowing the heat in the core to temper the tool before finally quenching.

Although for all ordinary purposes low-grade tool steel is still used, heavy roughing cuts are performed by means of air-hardening steel. These tools are heated to a white heat and cooled off in an air blast without further tempering. Since, however, Messrs. Taylor & White commenced experimenting with high-grade tool steels the industry has progressed considerably, and few are the shops where their presence is not evident. These high-speed steels are alloyed with chromium, tungsten and carbon, and the heating for hardening is carried up to 2000°F., much above anything previously attempted, so that a tool can now be worked up to a high temperature without losing its cutting edge, allowing of large increases in depth of cut and coarseness of feed—up to the limit imposed by the rigidity of the machine—this having resulted in a much heavier type of modern machine tool with large increase in driving power to cope with the additional load.

* For Articles I. to XV., see last fifteen issues.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Freire de Andrade.—On November 25th, there was launched from the yard of Earle's Shipbuilding and Engineering Company, Limited, Hull, a twin-screw cargo and passenger steamer, built to the order of Carlos Augusto Pereira Limitada, of Lisbon and Delagoa Bay. As the vessel left the ways she was gracefully christened *Freire de Andrade* by Mrs. Camillo de Canto, the wife of Captain de Canto, under whose supervision she has been constructed, and who will eventually take command. The principal dimensions are:—Length, 125 ft.; breadth, 25 ft.; depth moulded, 9 ft. 6 in. The vessel, which is intended for river service in Portuguese South-East Africa—her port of registry being Lourenzo Marques—is designed for a light draught of water. She is built of steel to 100 A1 Class in Lloyd's Registry, and has one deck with poop, bridge and forecastle erections. Accommodation is provided for passengers under poop and at sides under bridge deck. The captain is berthed in a teak house at forward end on bridge; the engineers and officers at sides of casing under bridge and the seamen and firemen in the forecastle. She is fitted with two pole masts, each with cargo derricks, two steam winches by Messrs. Lynn and Co., steam windlass by Messrs. Gemmell & Frow, steam-steering gear by Messrs. Donkin & Co., and has a complete installation of electric light, including a powerful searchlight on navigating bridge, supplied and fitted by Messrs. J. H. Holmes & Co. The propelling machinery consists of two sets of compound surface condensing engines specially designed for the light draught, and to attain a speed of 10 statute miles per hour, steam being supplied by one large cylindrical boiler working at 180 lbs. pressure. Among those present were Captain de Canto, Mr. F. Somerscales, Mr. and Mrs. Palethorpe, Mr. Sturrock and Mr. Read.

Slieve Gallion.—On December 4th, there was launched from the yard of Messrs. Vickers, Sons & Maxim, Barrow, the *Slieve Gallion*, sister ship to the *Slieve Bloom*, launched the previous month, both to the order of the London and North-Western Railway Company. These two vessels mark a new era in the Holyhead and Northwall (Dublin) service. They are intermediate steamers and are specially built for the carrying of produce and herds of cattle. The two decks used for cattle will be electrically ventilated and have a special system of drainage. They have special ballasting tanks, which will steady the steamers in a rough sea. The *Slieve Gallion* is 310 ft. 10 in. long, and has a breadth of 37 ft. and moulded depth of 15 ft. She is twin-screw, her engines being on the Yarrow Schlick and Tlocedy system. They are triple expansion with four cranks, which will secure a freedom from vibration. She will possess a certificate empowering her to carry just over 1000 steerage passengers and will, under economical steaming, maintain 16 knots.

Musketeer. On December 5th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, a steel screw steamer built to the order of Messrs. Fisher, Renwick & Co.'s Manchester-London Steamers, Limited, and of the following dimensions, viz:—Length, about 230 ft.; breadth, 33 ft.; depth moulded, 24 ft., and to class 100 A1 at Lloyd's on the awning deck rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including three double cylindered steam winches and three "Walters" patent slewing engines for working cargo, direct-acting steam windlass, large donkey boiler, steam-steering gear by Messrs. Donkin & Co., and Hastie's screw gear aft. The engines, which are supplied by Messrs. North-Eastern Marine Engineering Co., Ltd., of Wallsend, are of the triple-expansion type having cylinders 17 in., 28 in. and 46 in. by 33 in. stroke, and working at a pressure of 180 lbs. On leaving the ways the vessel was named the *Musketeer* by Miss Kathleen Fisher, daughter of Mr. Joseph Fisher of Higham Bassenthwaite Lake Cumberland.

Redwood.—On December 5th, the Blyth Shipbuilding Company, Limited, launched from their shipbuilding and graving dock works the fine steel screw steamer *Redwood*, built to the order of Messrs. The Tyneside Line Limited (Messrs. Jno. Ridley, Son & Tully, managers). This vessel, which measures 244 ft. in length with a beam of 33 ft. 6 in., has been constructed under Lloyd's special survey to class 100 A1. She is of the raised quarter-deck type, having short bridge and topgallant forecastle. The accommodation for captain is provided in the bridge, engineers and officers in sidehouses on raised quarter deck, and crew will be berthed in topgallant forecastle. The *Redwood* is specially adapted for the coal, ore and timber trade, having extra large self-trimming hatches, together with the best and latest design of deck machinery for the quick and economical working of the cargo. Triple-expansion engines of good power will be supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Sunderland. As the vessel glided down the ways the christening ceremony was gracefully performed by Mrs. Tully, of Hexham. An adjournment was afterwards made to the offices of the shipbuilders, when the success of the *Redwood*, her owners and other toasts were honoured. The hull and machinery have been constructed under the supervision of Mr. Jos. R. Scott, of Newcastle.

Westwood.—On December 5th, Sir Raylton Dixon and Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw steamer built with cantilever frames on Harroway & Dixon's, John Priestman's and Livingston & Sanderson's patents to the order of Messrs. Furness, Withy & Co., Ltd., of West Hartlepool. The vessel is being built to the highest class at British Corporation single-deck type, her leading dimensions being 286 ft. 4 in. and 40 ft. 5 in. by 20 ft. 11 in. moulded and will carry about 3300 tons on a light draught of water. A large steel deck-house on poop at fore end of boiler casing will be fitted up, containing captain's room, saloon and officers' accommodation, with wheel-house above, while the engineers will be berthed at sides of engine casing and crew in aft end of poop. She will have four exceptionally large hatchways, four water-tight bulkheads, two masts, four derricks, and will be equipped with four powerful steam winches, Cochran (Annan) patent vertical multitubular boiler fitted with patent seamless furnace, and all the latest and most modern appliances for the rapid handling of cargo. The vessel will also carry about 1050 tons of water ballast, 400 tons of which will be located in angular tanks under the deck and the remainder in double bottom and peaks. She will be fitted with engines placed aft, by Messrs. Richardsons, Westgarth & Co., Ltd., Middlesbrough, 20½ in., 33 in. and 54 in. by 36 in. stroke, with two large single-ender boilers working at 180 lbs. pressure. On leaving the ways she was gracefully named *Westwood*. The hull and engines are being constructed under the supervision of Mr. A. H. Walker and Mr. Tose, the owners' superintendents.

Whitby Abbey.—On December 5th, Messrs. William Gray & Co., Limited, launched at West Hartlepool the finely modelled steel screw steamer *Whitby Abbey*, which they have built to the order of Messrs. The Hull and Netherlands Steamship Co., Limited, Hull. The vessel will take the highest class in Lloyd's Register, and her dimensions are:—Length overall, 265 ft.; breadth, 33 ft. 6 in.; and depth, 16 ft. 3 in. She has a full poop, raised quarter-deck, long bridge and topgallant forecastle. A handsomely fitted-out saloon, smoke-room and cabins for forty-four first-class passengers will be fitted in houses on the bridge and accommodation for twenty-eight second-class passengers in the poop and forty-four steerage passengers forward. An installation of electric lighting, electric bells, steam-heaters etc., will be provided and the bridge fitted up for the carriage of about forty horses. The hull is built with deep bulb-angle frames, a cellular double bottom and peak tanks, large hatchways, five steam winches, steam steering gear, steam capstan aft, steam windlass, and a complete outfit for a first-class passenger and cargo steamer. The machinery, which is being made by The Central Marine Engine Works of the builders, has been designed to give the vessel a speed of at least 15 knots per hour, the engines having cylinders 25½ in., 40½ in. and 67 in. dia., with a piston stroke of 42 in. embodying special features to give the required power without unduly increasing the weight. Three boilers to work at a steam pressure of 185 lbs. are of the Central Marine well-known type with flanged shell; they are fitted with Howden's system of forced draught and internal feed heaters. The engine-room will be fitted up with numerous auxiliaries which will add to the efficiency of the machinery. The vessel and machinery have been built under the superintendence of Mr. W. H. Brodrick on behalf of the owners, and the ceremony of naming the steamer *Whitby Abbey* was gracefully performed by Mrs. Darwin,

Dryburn, Durham, daughter of the Right Hon. John Lloyd Wharton, chairman of the directors of the North-Eastern Railway Company, who was also present, together with Miss Lane Fox, Col. Darwin, Mr. Barraclough, Mr. and Mrs. Wm. G. Gray, Miss Muncaster, Mr. E. L. Davis, Mr. Ringrose etc.

Grantley.—On December 6th, Messrs. Osbourne Graham and Co. launched from their yard at Hylton the steel screw steamer *Grantley*, which they have specially built to the order of Messrs. Furness, Withy & Co. Ltd., West Hartlepool, for the Pomeran ore trade. She is a single-deck steamer designed to carry a large cargo on a moderate draught, and takes highest class at British Corporation. Accommodation is fitted in the poop, and the officers and engineers are situated amidships. Her deck equipment comprises all the latest appliances for quick handling of cargo, Cochran (Annan) patent vertical multitubular boiler fitted with patent seamless furnace, steam-steering gear, etc. Machinery is being fitted by Messrs. MacColl & Pollock, of Sunderland, capable of driving the vessel 9½ knots loaded at sea. The christening ceremony was gracefully performed by Miss Patterson, of Sunderland.

Pekin.—On December 7th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 120 ft. by 22 ft. by 12 ft. 3 in. moulded. The vessel has been built to the order of H. L. Taylor, Esq., of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes & Co., of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Pekin* by Mrs. Hopwood, of Grimsby, after which the company adjourned to the builder's offices, where breakfast was served and the customary toasts given and responded to.

Borborema.—On December 17th, Messrs. Craig, Taylor and Co., Limited, launched from their Thornaby shipbuilding yard, Thornaby-on-Tees, a handsomely modelled twin-screw steamer of the following dimensions:—286 ft. by 44 ft. 9 in. by 17 ft. 6 in. She is designed to suit the special trade of the Lloyd Brazileiro, and is of the single-deck type, with deck-houses amidships and forecastle forward, and is built under special survey to class with the British Corporation. The vessel has double bottom for water ballast in the holds, and has also water ballast in the peaks. She is fitted with patent vertical steam windlass with quick-warping ends, Hastie's Wilson-Pirrie patent steam-steering gear, placed in house aft, and worked from bridge amidships by telemotor; eight steam winches; double derricks for rapid loading and discharging, with gins and blocks having Reid's patent sheaves; Clayton fire and disinfecting machinery; electric light by Siemens Bros., and all modern improvements for a first-class cargo steamer for the Brazilian trade, including Wailes Dove's patent bitumastic enamel to the tanks, Christie's patent sparring cleats, litosilo to cabins, Hoskin's beds, whilst the lifeboats have Mill's disengaging gear. The machinery has been constructed by Messrs. Blair & Co., Ltd., Stockton-on-Tees, and consists of two sets of triple-expansion engines 14 in., 22 in., 37 in. by 24 in., with two large steel boilers working at 185 lbs. pressure. This is the eighth vessel Messrs. Craig, Taylor & Co., Ltd., have built for the Lloyd Brazileiro. The vessel has been built under the superintendence of Captain A. Rosauro de Almeida, assisted by Mr. H. Hudson, Mr. Hewrick, and Mr. Robinson. As the vessel left the ways she was gracefully christened the *Borborema* by Miss Georgina C. Young, sister of one of the directors.

John Miles.—On December 17th, there was launched from the shipbuilding and repairing establishment of Messrs. S. P. Austin & Son, Limited, Sunderland, the steel screw steam collier *John Miles*, which has been built to the order of Messrs. Stephenson, Clarke & Co., of London, and is the fourth vessel constructed for the same owners. She will be classed 100 A1 Lloyd's Register under special survey, has ample water ballast capacity, the accommodation for captain and officers is provided in the bridge, for engineers after under raised quarter-deck, and for the crew in forecastle. Steam windlass, steam winches and donkey boiler have been supplied, steam-steering gear by Davis & Co., Ltd., and the vessel is in every respect specially adapted for quick loading and discharging. The machinery will be supplied by the North-Eastern Marine Engineering Co., Ltd.

Dacre Castle.—On December 19th, Messrs. R. Craggs and Sons, Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer 392 ft. 6 in. long by 50 ft. 6 in. beam by 28 ft. depth moulded. This vessel is being built under special survey to take the highest class at Lloyd's, being of the shelter-deck type. The specifications of both hull and machinery are very complete in every way to fulfil the owners special requirements. Cellular double bottom is fitted throughout for water ballast, which is also carried in the fore and after peaks and a specially designed deep tank, the total amount being about 1750 tons. A special feature of this vessel's construction is the arrangement of the framing, which is carried out on the "C" system patented by the managing director, Mr. E. Hall Craggs, which affords considerable advantage to the owners in regard to carrying capacity and clear stowage. The construction of hull and machinery has been carried on under the superintendence of Messrs. E. H. Bushell, Fletcher and King, of Liverpool. Ten powerful steam winches are provided of the most approved type, steam-steering gear is also supplied, and improved quick-warping steam windlass is fitted forward. The arrangements for handling ship and cargo are most complete in every respect with double derricks throughout, and two strong derricks to lift 30 and 20 tons respectively, fitted at the main hatches. The machinery will be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, and will have cylinders 26½ in., 44 in., 72 in. by 48 in. stroke, steam being supplied by two large single-ended boilers working at 180 lbs. pressure to the square inch, fitted with Howden's forced draught and capable of developing a speed of 11 knots in service. The vessel has been built to the order of The Lancashire Shipping Company, Ltd., of Liverpool, and on leaving the ways was named *Dacre Castle* by Mrs. Chambers, the wife of the managing director.

Romanby.—On December 19th, Messrs. Ropner & Sons, Limited, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length, 365 ft.; breadth, 50 ft.; depth, 23 ft. The vessel is built to the highest class of British Corporation to the order of Messrs. R. Ropner & Co., West Hartlepool, and is fitted with the builders' patent improved trunk deck, with clear holds and deep frames. The saloon house with accommodation for captain and officers and a house for engineers, is fitted up on trunk deck, with the crew in top-gallant forecastle and apprentices aft. The vessel has double bottom for water ballast on the cellular principle, also in the fore and after peaks. The deadweight carrying capacity will be about 6100 tons on her summer freeboard. The vessel will be fully equipped with an up-to-date outfit, having a quick-warping windlass, stockless anchors, steam-steering gear amidships, with powerful screw gear aft. The appliances for loading and discharging expeditiously are very complete, and include extra derrick posts and double derricks, nine steam winches, steam being supplied by a horizontal multitubular donkey boiler. The engines will be of the triple-expansion type, supplied by Messrs. Blair & Co., Ltd., of about 1500 I.H.P., steam being supplied by two large main boilers, at a working pressure of 180 lbs. per square inch. The christening ceremony was gracefully performed by Miss Ropner, Ragworth, Norton-on-Tees, who gave the vessel the name of *Romanby*.

Tuscany.—On December 19th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, launched the handsome steel screw steamer *Tuscany*, built for the Gulf Line, Ltd.. She is of the following dimensions:—336 ft. by 47 ft. by 24 ft. 10 in., having single deck, poop, bridge and top-gallant forecastle, and has been built to 100 A1 at Lloyd's. A double bottom is fitted throughout on the cellular principle, and the fore and after peak tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stringers, giving clear holds for the storage of bulky cargoes. Five water-tight bulkheads divide the holds into six water-tight compartments, wood grain divisions are fitted in the holds. She also has extra large cargo hatches, steam winches, which are supplied with steam from a vertical multitubular donkey boiler and is replete with all the latest improvements for rapid loading and discharging. A powerful quick-warping steam windlass is fitted forward for the working of the cables and steam-steering gear is fitted amidships with hand-screw gear aft. Accommodation for captain and officers is arranged

in poop, engineers in houses amidships, crew and firemen in forecastle. The sanitary, ventilating, and lighting arrangements have received special attention, and have been effected on the most approved lines. Triple-expansion engines are being supplied and fitted by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, having cylinders 24 in., 38 in., 64 in. by 42 in., two large single-ended boilers, 160 lbs. pressure. The vessel was named *Tuscany*.

Flora.—On December 21st, Messrs. Wood, Skinner & Co., Limited, of Bill Quay, Newcastle-on-Tyne, successfully launched from their shipbuilding yard a new steel screw cargo and passenger steamer which has been built by them to the order of Messrs. Schill, Seebohm & Co., Limited, of Manchester. The vessel has been built to Lloyd's classification and is fitted with upper, shade and promenade decks. Large steel houses are built between the shade and promenade decks to provide accommodation for first-class passengers. The officers and engineers are berthed in a steel deck-house on the shade deck aft of the engine casing. A large steel deck-house will also be fitted on the promenade deck containing dining-saloon and smoke-room and a smaller house with captain's accommodation, chart and wheel-house, etc. The crew's accommodation will be fitted on the upper deck at the fore and after ends of the vessel. Water ballast is provided in the cellular double bottom, and two of the double bottom tanks, as well as the fore and after peaks, will be arranged to carry fresh water for the supply of cattle which will be carried in the upper deck. The vessel has been specially designed for trading between Valparaiso and Panama, and has been superintended during construction by Mr. William J. Periton, of Liverpool. The machinery, which is of the improved triple-expansion type, has been constructed and will be fitted by Messrs. George Clark, Limited, of Sunderland. The vessel was gracefully christened *Flora* by Miss Schill, daughter of Mr. Paul N. Schill, of Manchester, one of the directors of Messrs. Schill, Seebohm and Co., Limited.

Rievaulx Abbey.—On December 23rd a handsomely modelled steamer, which no doubt will prove a great acquisition to the Hull and Rotterdam passenger and cargo trade, was successfully launched from the yard of Earle's Shipbuilding and Engineering Company, Limited, Hull, by Mrs. Marshall Ringrose. The vessel, which was gracefully christened the *Rievaulx Abbey*, by Mrs. Marshall Ringrose, is the first of two vessels building to the order of the Hull and Netherlands Steamship Company, Limited, Hull. The principal dimensions are: Length, 255 ft.; breadth, 33 ft. 6 in. moulded; depth, 16 ft. 3 in. moulded. She has been built of steel to Lloyd's 100 A1 Class, and is of one-deck type with poop, bridge and forecastle erections, also a boat deck which forms a promenade. She will be fitted with two pole masts and the necessary derricks and gear for the rapid handling of cargo, four powerful steam winches, steam windlass and steam capstan, steam-steering gear by Messrs. Amos & Smith, and hand-steering gear by the Carron Co. There is accommodation for forty-eight first-class passengers in commodious rooms on bridge deck amidships, and in house on boat deck, also spacious dining-saloon and smoke-room amidships; lavatories are arranged adjacent to the state-rooms. Good accommodation is also provided for twenty-eight second-class passengers under poop deck and forty-four third-class under main deck forward. The officers, engineers and stewards are berthed alongside engine casing under bridge deck, and the seamen and firemen in forecastle. A complete installation of electric lights and bells will be fitted throughout the whole of the vessel by Messrs. Clarke, Chapman & Company. The propelling machinery will consist of a set of triple expansion surface condensing engines, having cylinders 25¼ in. 40½ in., 67 in. diameter with a stroke of 42 in. Steam will be supplied by three large cylindrical single-ended boilers with forced draught on the closed ashpit system, the air being supplied by a large fan and engine in the engine room. The machinery will be of the most up-to-date design with large bearing surfaces for continuous running and will indicate about 3000 horse power. The ship and engines have been constructed under the superintendence of Mr W. H Brodrick.

LAUNCHES—Scotch.

Luna.—On November 23rd, there was launched by The Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, a steel screw steamer 315 ft. by 46 ft. 6 in. by 23 ft. 4½in., and about 4,700 tons dead weight, built to the order of the Navigazione Libera Triestina Societa in Azioni of Trieste. The vessel was named *Luna*, and immediately after the launch was berthed in the Company's Dock to receive her machinery, which has also been constructed by the builders.

Tocantins.—On November 23rd, there was launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, a steel twin-screw steamer of the following dimensions:—Length 187 ft. breadth 33 ft., depth to promenade deck 19 ft. The vessel has been specially designed for service on the River Amazon, and has accommodation for 44 first-class passengers in state-rooms. Many novel features have been introduced in the steamer, embodying the following:—On the main deck there is a large refrigerating chamber from which drinking water and beer can be pumped up to the bar on the promenade deck. There is a doctor's room and pharmacy with all appliances fitted up. On the uppermost deck of all there is a smoke-room, the windows of which have large coloured photographs, representing scenes on the lower and upper Amazon, and in this room there is a piano which plays automatically on the "coin in the slot" system or as an ordinary instrument. On the top of the chart-house there is a sky sign which will electrically show the vessel's name at night in several colours. A very powerful steel steam launch is being fitted on board and an apparatus for running up flag signals simultaneously. Each hold is sounded by an electrical apparatus which, in the event of water getting into any hold, will at once register the particular hold and quantity of water on an indicator board in the Captain's room. The steamer was named Tocantins, by Miss Margaret Murray, Norwood, Port Glasgow, and was taken to Greenock, where a large double-ended boiler and powerful triple expansion engines will be fitted on board by Messrs. J. G. Kincaid & Co., Ltd. The vessel and her machinery have been superintended during construction by Dr. Talisman Teixeira, Brazil.

Manco.—On November 27th, Messrs. Scott's Shipbuilding and Engineering Co., Ltd., launched from their Cartsdyke Shipyard, Greenock, the steel screw passenger and cargo steamer *Manco*, which they have built to the order of the Iquitos Steamship Co., Ltd., of Liverpool, which is associated with, and under the management of, the Booth Steamship Co., Ltd., of Liverpool. The principal dimensions of the vessel are:—Length between the perpendiculars 300 ft., breadth moulded 45 ft., depth moulded 23 ft. 6 in., gross tonnage about 3,100 tons. Above the upper deck are a long combined poop and bridge, and a topgallant forecastle, the bridge being surmounted by a promenade deck, over which is a boat deck also serving as the navigating bridge. A docking bridge is fitted on poop deck. The vessel is classed 100 A1 at Lloyd's, but is very much in excess of their requirements, the strength of the upper works and deck-houses having received special consideration. The decks are of teak, and for service under tropical conditions awnings are fitted all fore and aft. Water ballast is carried in the double bottom, the peaks and also in deep hold tanks. The vessel has been specially designed for the Iquitos trade, which, in addition to the Atlantic passage, involves a voyage of some 2,000 miles up the River Amazon. The accommodation for passengers is fitted in accordance with the best modern practice, the state rooms being large and well ventilated, and fitted with iron beds, folding lavatories, electric light and electric fans. The saloon, music room and smoke-room are handsomely decorated, the details having been designed by the owners' architects, Messrs. Willink and Thicknesse, of Liverpool. The first-class accommodation is situated on the upper promenade and boat decks. Adjacent to the saloon are a large pantry and galley fitted with cooking range, baker's oven, grill, hot presses and various steam boilers and steam ovens. Rooms are provided for a doctor and a nurse, and hospitals for first and third class passengers. The accommodation for third-class passengers is situated under the after-end of the poop, a large galley with range and steam boilers being fitted for their use. The accommodation for crew and stewards is fitted under the forecastle and the poop, the berths being of iron and the lavatory accommodation unusually complete. A large mess room is also provided for each section of the crew. The provisioning arrangements of the vessel have received special consideration, and include a large refrigerating

chamber and machine, ice box, potato locker, flour room, wine store, etc. For the carriage of explosives large magazines of special construction are fitted. The accommodation throughout is heated by means of steam radiators, and the ventilation is of the most complete description. The arrangements for dealing with cargo include ten derricks fitted on the masts and worked by powerful steam winches. In addition to these a special steel derrick is fitted which can be arranged to work either the forward or after hatches. In order that this derrick may be capable of lifting lighters and steam launches on to the deck of the ship, it has been constructed for a working load of 45 tons, the masts, decks, rigging and other parts affected having been specially strengthened for the purpose. The sanitary arrangements throughout are of the most modern description, including hot water service to baths and basins. The steering gear is by Messrs. Brown Bros. & Co., Edinburgh, and is controlled by their patent telemotor gear. In addition to the usual telegraphs, a complete system of telephones is fitted. The vessel is fully equipped with lifeboats, and in addition is supplied with a steam launch. The refrigerating machine is on the Co^2 system, and has been supplied by the Liverpool Refrigeration Co., Ltd. The electric lighting is on a very complete scale and has been fitted by Messrs. Campbell & Isherwood, Liverpool. The hull has been built under the personal supervision of Mr. W. Isaacs, the chief of the owners' construction department. Captain Dale will command the ship when completed. The main propelling engines are of the triple-expansion type, the cylinders being 23 ins., 38 ins., and 64 ins. diameter, with a stroke of 42 inches. The H.P. and M.P. cylinders are fitted with piston valves, and the L.P. with a double-ported flat slide valve. The condenser is built of steel plates, independent of the engine frame work. The back columns are of cast iron and also carry both the ahead and astern guides. The front columns are of forged steel. The valve gear is of the Stephenson double bar link type, which is operated direct by a Brown's oscillating type steam-reversing engine. An Edward's air-pump, main-feed pumps, bilge and sanitary pumps are worked in the usual manner by means of a rocking shaft and side levers from the L.P. crosshead. The shafting is of steel, in excess of the requirements of Lloyd's and Board of Trade, and drives a propeller of the built type. Cedervall's patent protective adjustable lubricating box is fitted. A steam-turning engine and gear with machine-cut teeth, are provided for turning the main engines in port. A centrifugal circulating pump with double engines is supplied for circulating the water through the condenser. The remaining auxiliary machinery includes—a general donkey, auxiliary condenser, circulating pump, wash deck, sanitary, ballast and fresh-water pumps—all of the duplex type. A 20-ton Morrison's evaporator, "Contraflo" auxiliary condenser, Hocking's feed-water filter and feed water heater. Two dynamos driven by compound steam engines, are also fitted in the engine-room. Steam is supplied to the engines by two single-ended main boilers, 16 ft. diameter and 11 ft. 9 ins. long. The boilers are constructed for a working pressure of 180 lbs. per square inch, and are fitted to work under forced draught on Howden's system. For supplying steam to the winches and other deck machinery, a large vertical Cochran donkey boiler is fitted; a Clarke Chapman pump with float tank is supplied for feeding this boiler. The whole of the machinery and boilers is of first class design and finish, and has been constructed under the personal supervision of Mr. William Beckett, Superintendent Engineer to the owning Company. As the vessel left the ways, the naming ceremony was performed by Mrs. Charles Booth.

Liberty.—On December 4th, Messrs. Ramage & Ferguson, Ltd., launched at Leith the twin-screw steam yacht *Liberty*, which they have built for Mr. Joseph Pulitzer, of New York, from designs by Messrs. G. L. Watson & Co., Glasgow. The christening ceremony was performed by Miss Tuohy, the daughter of Mr. Pulitzer's London representative. The *Liberty*, which is one of the largest private yachts afloat, is 300 feet long, 35 feet 6 ins. broad, and of 1570 tons yacht measurement. The yacht is intended for ocean cruising and her bunker capacity is sufficient to enable her to steam to New York and back without coaling. Two powerful sets of triple-expansion engines drive the twin screws, which, to lessen vibration, are of different pitch, and will be run at different speeds. The electric equipment is unusually large, as much of the deck machinery is driven by electricity instead of steam. The yacht has many novel features. In the first place the owner's library and dining room, drawing-room and smoking-room are all contained in a long deck-house on the shade deck. The scheme of decoration is simple, and suggests solid substantial comfort rather than elaborate carving, etc. The dining-room and smoking-room are in oak, while the walls of the drawing-room are covered with brocade. All the accommodation for owner and guests is on the main deck. There are twelve guests' bed-rooms, several of which are arranged *en suite* and a dainty little ladies' boudoir is added to one of the suites. Another novel feature is the gymnasium, a room 20 feet square and 14 feet high, placed in the forward part of the ship. Particular care has been taken in the construction of the owner's sleeping apartments to ensure perfect quiet. These rooms are isolated from the rest of the accommodation, and by means of a system of steel bulkheads specially deafened, all noises from the engine-room are excluded. The crew are berthed aft on the lower deck, a passage running the length of the ship on this deck giving access to the forecastle head without the necessity of passing along the shade deck. A fine chart house is provided over the after end of the dining-room, and the navigating bridge is above this. The yacht has all the graceful lines of a "Watson" boat, and should prove an exceptionally fine craft in a heavy sea.

Suruga.—On December 17th, Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer *Suruga*, which they have built to the order of The New York and Oriental Steamship Co., Ltd., of which Messrs. Barber and Co., New York, are managers. The vessel is of the following dimensions, *viz.* :—Length, 387 ft. 6 in.; breadth, 52 ft., and depth moulded, 28 ft., and has a long bridge, on top of which is placed accommodation for captain, officers and engineers, besides a number of spare state rooms, while the poop is fitted up for a native crew. The vessel is constructed with holds clear of obstruction, and is fitted with all up-to-date appliances or the rapid handling of cargo, including derricks, etc., for heavy lifts. A complete electric installation has been fitted. The Rich fire indicating system is installed throughout and, in the event of a fire occurring in any part of the vessel, this can be immediately extinguished by steam. The machinery is being supplied by The Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow. The vessel and machinery have been built to Lloyd's highest class, and under the superintendence of Mr. E. H. Bushell, of Messrs. M. H. Bushell, Fletcher & King, naval architects, Liverpool and Captain W. T. Chubb, the owners' superintendent. The naming ceremony was performed by Mrs. Barnett, of Egremont, Cheshire, wife of Mr. Barnett, the European agent for Messrs. Barber & Co.

Hesperian.—On December 20th, Messrs. Alex. Stephen and Sons, Ltd., launched at Linthouse, the twin-screw steamer *Hesperian*, the second of the two large passenger and cargo steamers they have built this year for the Allan Line service between Glasgow and the Dominion of Canada. The Hesperian is 502 feet in length, with a breadth of 60 ft, and a depth to shelter deck of 41 ft. 6 ins.; the gross tonnage is about 10,000. She is built to British Corporation classification, and is specially strengthened for the North Atlantic trade. Accommodation is provided for 500 first and second-class cabin passengers, and for about 1,400 third class—the latter being housed in four berth rooms. Large and well appointed dining-saloons, music-rooms, libraries, etc., etc. are provided for each class of passengers; the whole being very tastefully panelled and decorated. The vessel will have a deadweight capacity of about 9,000 tons, and an insulated space of large capacity for storage of cargo and ship's provisions, cooled by Co^2 refrigerating machinery. The engines and boilers are similar in every respect to those fitted into the sister ship the *Grampian*, which was launched from same yard last July, and is now in commission. The ship is lighted throughout by electricity, the plant being duplicated in order to ensure an unbroken supply. In addition to natural ventilation, the tween decks and emigrant spaces are heated and ventilated on the thermo-tank system. The christening ceremony was performed by Miss Winifred Lauder, grand-daughter of the late Mr. Alexander Allan.

Cariboo.—On December 23rd, there was successfully launched from the Ayr yard of the Ailsa Shipbuilding Co., Ltd., of Troon and Ayr, a handsomely modelled twin screw

steamer built to the order of Canadian owners. The vessel is a three decker, intended for their passenger trade, and is fitted up with electric light and all the most modern appliances of a first-class passenger steamer. She will shortly be towed to Belfast to receive her machinery, which is being constructed by Messrs. MacColl & Co., Ltd., Abercorn Basin, Belfast. On leaving the ways the vessel was gracefully christened *Cariboo* by Mrs. James Maxton, Belfast.

LAUNCHES—Irish.

Coppename.—On December 5th, Messrs. Workman, Clark and Co., Ltd., Belfast, launched from their South Yard the first of two steamers being built by them for Messrs. The Royal West Indian Mail Co., of Amsterdam. The new steamer has been named *Coppename* and is intended for the West Indian fruit-carrying trade and is the twelfth vessel specially designed and built for this trade by the above firm, who have at present several other vessels in course of construction, which are intended to be employed in the fruit-carrying trade. The *Coppename* is 352 feet in length with a gross tonnage of about 3,500 and has been built under special survey for the highest class in Lloyd's Registry of Shipping. She is of the spar-deck type with a long bridge and top-gallant forecastle and has three complete steel decks. The cargo space is divided by the decks and bulkheads into fourteen compartments, eight of which have been specially insulated and fitted up for the carriage of fruit cargoes in bulk. For the purpose of keeping the fruit in good condition during the voyage, the various fruit compartments are fitted with ducts for the conveyance of cool fresh air from the cooler rooms on the deck, the refrigerating machinery being placed in the engine-room ; and in addition an efficient system of ventilation has been arranged. The cargo hatches are each equipped with the necessary deck machinery and approved appliances specially adapted for expeditiously handling fruit cargoes. Accommodation for a number of first-class passengers is being arranged in comfortable state-rooms in a large house on the bridge deck and at the ship's side on the spar deck, with a large dining saloon extending the full width of the vessel at the forward end of the bridge space. From the saloon passage a broad stairway leads up to the social hall or lounge on the bridge deck, adjoining which there is a large smoke-room. The officers' and engineers' quarters have been arranged on the spar deck amidships, while the crew are berthed in a steel deck-house aft, and the petty officers in the forecastle. The machinery and boilers have been constructed in Messrs. Workman, Clark & Co.'s Queen's Road Works, and consist of a set of triple-expansion engines, having all the necessary auxiliary appliances, and three steel cylindrical multitubular boilers working under Howden's system of forced draught.

Ancona.—On December 19th, Messrs. Workman, Clark and Co., Ltd., Belfast, launched from the North Shipyard the first of two steamers being built by them for the Steam Navigation Co., Italia, D' Genova. A distinguished company assembled to witness the interesting function, amongst those present being His Grace the Duke d' Andria, Senator of the Italian Kingdom, and a director of the Italia Company, Geo. S. Clark, Esq., M.P., Chas. E. Allan, Esq., J. Connel, Esq., Mr. G. E. Clark, Jnr., Mrs. Geo. S. Clark, Mrs. John Lepper, Mrs. Garrett Campbell, Miss Violet Ardill, Miss O'Brien, Miss Campbell, Major-Engineer Lauro, of the Royal Italian Navy, and Captain Lavatelli, who are superintending the construction of the vessel, Mr. John Burke, J.P., local Italian Consul, Mr. E. J. Milton, Mr. J. Lewis, Mr. Llewellyn Williams (Boston, U.S.A.). As the vessel left the launchways she was gracefully named *Ancona* by Miss Violet Ardill, of Greystones, Ayr, Scotland, representing the Duke D' Andria, Senator of the Kingdom of Italy, who at a given signal performed the duty of releasing the vessel. The *Ancona* is 500 feet in length with a gross tonnage of about 9,000 and has been specially designed for her owners' passenger service between Genoa, Naples and New York. She has been built under the special survey of the British Lloyds, and the Registro Italiano for the highest class in their registers and also fulfils all the requirements of the laws of the Italian Mercantile Marine and of the United States Department of Commerce. In the design and arrangement of the vessel very special attention has been given to the requirements of the American emigrant trade, and the vessel will be found to be one of the most complete in this service. Accommodation will be provided for over sixty first-class passengers in state-rooms in the promenade deck-house, with a large dining-saloon, with music-room or lounge adjoining, placed at the fore end of the deck-house. Emigrant accommodation has been arranged in the bridge deck-house, in the poop and on the main and lower decks forward and aft, the berths being fitted in blocks and two in the height, accommodation being provided for about 2500 persons. Dining spaces for emigrants, furnished with strong tables and forms, have been arranged in the bridge space and on the main deck amidships. The sanitary arrangements throughout every part of the vessel have received very special consideration, and will be found to be of the most satisfactory character ; all the lavatories being provided with plunge baths and showers, having hot and cold salt and fresh-water services. A special feature has been made of the ventilation of every compartment, both by natural and artificial means ; the mechanical ventilation being on the thermo tank system by means of which a change of cooled or warmed fresh air can be made six times in the hour, thus securing an even temperature under any climatic condition. A very complete installation of steam heating has been fitted throughout the first-class accommodation, captain's, officers' and crew's quarters. The galley, pantry and laundry arrangements are of the most complete nature, the appliances in each of these departments being all of the latest type. To ensure a regular and plentiful supply of fresh meat, fish, butter, eggs, milk, for the daily use of such a large complement of passengers and ship's company necessitates a great deal of care ; for the preservation of this large quantity of goods a large space has been set apart on the lower and orlop decks aft. The space on the lower deck has been arranged for ordinary steward's stores, while the space on the orlop deck has been thoroughly insulated and prepared for the reception of perishable stores, for the preservation of which an efficient installation of refrigerating machinery on the Co^2 or Carbonic Acid system has been fitted up. The space below the lower deck all fore and aft, also the lower 'tween decks, when not needed for the accommodation of emigrants is available for general cargo purposes, and is divided by steel bulkheads into five spacious holds. The arrangements on deck for working the cargo are of the most complete character, there being six large hatchways equipped with ten steam winches of the most powerful type, and a suitable number of derricks swung from the masts and special derrick posts. The propelling machinery consists of two sets of triple-expansion engines having all the latest improvements and complete with all the necessary auxiliary appliances, and supplied with steam from three steel multitubular cylindrical double-ended boilers, working under Howden's system of forced draught. The arrangements for the launch were of the usual complete character, and the proceedings passed off in the most satisfactory manner. Immediately on entering the water the vessel was taken in charge by the tug boats which were waiting in readiness and brought alongside the finishing wharf to receive the machinery and internal fittings. The designing and construction of the vessel has been carried out under the direction and supervision of Colonel Squarzini, of the Royal Italian Navy, and Captain Roncallo, Naval Superintendent for the Italia Company.

Pericles.—On December 21st, this fine, large steel twin-screw steamer, built by Messrs. Harland & Wolff, Ltd., Belfast, to the order of Messrs. Geo. Thompson & Co., Ltd., London, for the Aberdeen-Australian Line, was successfully launched at Belfast. The launch of this vessel is an event of great importance, both to the United Kingdom and Australia, and while indicating the continued foresight and enterprise of the owners, is practical evidence of the increasing trade between distant portions of the British empire. Like other vessels of the line, the new steamer bears the name of a great ancient hero, and the name of *Pericles*, associated as it is with the highest development of Ancient Greece, is an appropriate designation for a vessel which is to be identified with the commercial development of the great modern empire, and a vessel which, moreover, in herself will represent the highest attainments in the art of shipbuilding—an industry that has played an important part in the progress of the world. The new vessel is about 500 ft. long by 62 ft. beam, and has a tonnage of about 12,000, consequently she will be one of the largest vessels engaged in the trade ; more-

over, the excellence of her passenger accommodation and her complete installation of refrigerating plant, insulated chambers and general cargo arrangements will make her one of the best combined passenger and cargo steamers afloat. As the vessel left the ways she was gracefully christened by Mrs. Sanderson, wife of Mr. H. A. Sanderson, chairman of the line, who was also present at the launch, together with Mr. G. T. Henderson, Mr. Stephen Thompson, Mr. Oscar Thompson and Mr. Fletcher, directors of the company, and Lord and Lady Pirrie, and a large party, who afterwards were entertained at lunch in one of the firm's offices.

LAUNCH—French.

Saint-André.—On November 21st, the steel screw steamer *Saint André* was launched from the yard of the Ateliers et Chantiers de France, Dunkirk, by whom she has been built and engined to the order of the Société Navale de l'Ouest, Hâvre. The builders have in hand six vessels of this type for the same owners. They are built to the highest class in Bureau Veritas and have the following dimensions: Length, 280 feet; breadth, 39 feet; depth, 28 feet, and have a deadweight capacity of about 3,000 tons on a light draught. There are four holds, each being provided with a large cargo hatch, equipped with steam winches, derricks and steam cranes, the whole suitably disposed to facilitate the rapid and economical handling of light cargoes. The machinery consists of a set of triple-expansion engines, steam being supplied by two single-ended boilers working under Howden's system of forced draught, which are also being built by the Chantiers de France.

TRIAL TRIPS.

Lynrowan.—On November 23rd, the large steel screw steamer *Lynrowan* (of which we gave particulars in our December issue, page 194), built by Messrs. R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough, for the Liver Shipping Co., Ltd., of Liverpool (Messrs. Johnston, Sproulè &, Co., managers), proceeded to sea to complete her official trials in a loaded condition. The results were pronounced entirely satisfactory to all concerned, the vessel registering a speed of 11·6 knots during a continuous run extending over three hours. Messrs. S. T. Taylor & Sons, Scotswood-on-Tyne, have covered the donkey boiler on this vessel with their 'Tynos' non-conducting material.

Elfrida.—On November 25th, the steel screw steamer *Elfrida*, built by Messrs. Wood, Skinner & Co., Ltd., of Bill Quay-on-Tyne, to the order of Mr. Alfred Brewis, of Newcastle-on-Tyne, left the Tyne for her official trial trip. This vessel is of the single-deck type, with poop, bridge and topgallant forecastle, to Lloyd's highest class, and under their special survey, and is rigged as a two-masted schooner. The propelling machinery, which has been constructed at the Northumberland Engine Works of Messrs. The North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, consists of a set of their latest type of triple-expansion engines, having cylinders 23 in., 37½ in., 61½ in. by 39 in. stroke, steam being supplied by two large steel boilers working at a pressure of 180 lbs. per square inch. During the run on the measured mile the machinery worked without the slightest hitch, and a mean speed of 11½ knots was attained, which was considered most satisfactory by all concerned. Amongst those present on the run were Mr. Norman Burnett, under whose supervision both hull and machinery have been constructed, Mr. Jas. Skinner and Mr. Leslie Skinner representing the shipbuilders, and Mr. J. Daglish representing the engine builders.

Kia Ora.—On November 27th the new steel twin-screw steamer *Kia Ora* (of which we gave particulars in our November issue, page 157), built and engined by Messrs. Workman, Clark & Co., Ltd., Belfast, for the Shaw Savill & Albion Co., Ltd., London, left the outfitting berth at Milewater Basin, alongside the builders' North Yard, and proceeded down the Belfast Lough for adjustment of compasses and to undergo the speed trials, after which the steamer left for Cardiff for coaling previous to proceeding to Glasgow and Liverpool to take in cargo for New Zealand. The results of the trial trip proved highly satisfactory. The owners were represented by Captain McKirdy, R.N.R., and Mr. Geo. Adams, who have supervised the design and construction of the vessel. The *Kia Ora* is commanded by Captain Thomas Harry Chudley, R.N.R., who has been in the service of the Shaw Savill and Albion Company for a period of seventeen years. Messrs. S. T. Taylor & Sons have covered the five boiler bottoms with their well-known Tynos patent removable asbestos mattresses.

Harlseywood.—On December 7th, the s.s. *Harlseywood* (of which we gave particulars in our December issue, page 195), built by Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, to the order of Messrs. the Constantine & Pickering Steamship Co., of Middlesbrough, made her official trial trip in the Tees Bay, when she attained an average speed of about 10 knots per hour. The trial trip passed off in every way satisfactorily. The owners were represented by Mr. William Constantine and Mr. B. Constantine, and Mr. L. R. Garthwaite was present on behalf of the builders.

Crispin.—On December 9th, the passenger and cargo steamer *Crispin* (of which we gave particulars in our November issue, page 155), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyard, Middlesbrough-on-Tees, to the order of the Booth Steamship Co., Ltd., of Liverpool, proceeded to sea for her official trials, which passed off most successfully, and the vessel proceeded to London to load. Messrs. S. T. Taylor & Sons have covered boilers, etc., of this vessel with their Tynos non-conducting material.

Cubatao.—On December 10th, the steel screw steamer *Cubatao* (of which we gave particulars in our December issue, page 194), built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of Messrs. Lloyd Braziliero of Rio de Janeiro and London, was taken to sea for her trial trip, which proved highly satisfactory. The machinery during the whole of the run worked with the greatest smoothness, a speed of 10¾ knots being maintained. The vessel has been built under the superintendence of Captain A. Rosauro de Almeida, assisted by Mr. H. Hudson Mr. Newrick and Mr. Robinson, and all of these gentlemen, who were on the trial trip, expressed themselves as being highly pleased with the ship and engines. The electrical installation has been fitted under the supervision of Mr. Tubby, who was also present on the trial.

Ophir.—On December 12th, the steel screw steamer *Ophir*, recently launched by the Ailsa Shipbuilding Co., Ltd., Troon and Ayr, at their Ayr Yard, for Liverpool owners, proceeded to sea on her trial trip. The vessel is intended for the coasting trade, is built to Lloyd's highest class, and carries about 600 tons. After adjusting compasses, trials were run which proved to be highly satisfactory.

Cedarwood.—On December 16th, this steamer (of which we gave particulars in our December issue, page 196), built by Messrs. W. Harkess & Son, Ltd., of Middlesbrough, for the Meteor Steamship Co., Ltd., of Middlesbrough, went to sea for her official trials, which passed off most successfully, and she proceeded to Dunston to load.

Buffalo.—On December 17th, the screw steamer *Buffalo* (of which we gave particulars in our December issue, page 195), built by Earle's Shipbuilding and Engineering Co., Ltd., Hull, for Messrs. Thomas Wilson, Sons & Co., Ltd., was taken on trial. After adjustment of compasses the vessel proceeded down the river and out to sea. The engines were worked up to their highest speed for some hours and worked the whole of the time without the slightest hitch, the result of the trial being considered highly satisfactory by all parties. The owners were represented by Mr. W. S. Hide, Captain Jones, Mr. Duguid and Mr. Brackenbury, and the builders by Mr. A. H. Tyacke and Mr. Sturrock, and Mr. Nicol represented the British Corporation.

Royal Prince.—On December 18th, the s.s. *Royal Prince* (of which we gave particulars in our November issue, page 156), built by Messrs. Short Brothers, Ltd., Sunderland, for the Prince Line Ltd., Newcastle-on-Tyne, left the Wear for her official trials, which were very successful, the machinery running smoothly throughout and a mean speed of 12½ knots being reached.

Verdi.—On December 18th, the new Lamport & Holt liner s.s. *Verdi*, built and engined by Messrs. Workman, Clark & Co., Ltd., left the Belfast Harbour and proceeded down the Lough for adjustment of compasses and to undergo

the speed trials, after which she proceeded to Birkenhead for coaling prior to her departure for New York. The *Verdi* has been specially designed, built and equipped for the South American passenger and cargo trade, and is 445 ft. long with a gross tonnage of 6577 tons. Special attention has been given to the first-class passenger accommodation, which is arranged amidships on the upper, shelter, bridge and promenade decks. There are upwards of fifty large and well-appointed state-rooms arranged along the sides of the vessel and designed to give the maximum of comfort in a hot climate. Several pairs of these rooms have communicating doors so that they can be occupied as family suites if so desired. These state-rooms are tastefully furnished in mahogany and the walls being enamelled white have a comfortable cool appearance, which will be much appreciated in the warm climates for which the vessel is intended. The dining-saloon is a handsomely-designed apartment placed at the forward end of the bridge-house and extending the full width of the vessel. The walls are panelled in light oak with gold ornaments, while the ceiling is finished in white. The furniture, which is all in oak of the same shade as the panelling, has been arranged on the restaurant principle, accommodation for over 150 persons being provided. This apartment is efficiently lighted by large cottage windows at the fore end and large round lights along each side. The pantry, placed convenient to the saloon, is replete with modern appliances necessary for an efficient service. From the after end of the saloon a series of well-proportioned oak staircases lead up to the entrance hall on the bridge deck and the saloon lounge on the promenade deck. From the entrance hall we have access to the bridge deck. At each end of this deck sheltered recesses have been arranged and provided with comfortable garden seats. The saloon lounge on the promenade deck is a most luxurious apartment, the walls and ceiling of which are finished in white, the panelling being relieved with beautifully-painted medallion portraits of the world's famous musicians, done in the Bartilozzi style, the portrait of Verdi, the famous composer, being placed over the piano. The furniture consisting of book-cases, writing-tables, chairs and settees, is in light oak, the seats being upholstered in tapestry. The room is lighted by large cottage windows shaded by dainty coloured silk curtains. The boat deck affords ample space for promenading, and from this deck you enter the smoke-room, which is handsomely panelled and furnished in walnut the settees and chairs being upholstered in crimson leather. Adjoining this apartment a well-sheltered alcove has been built and suitably furnished with tables and comfortable chairs, affording a pleasant lounge in the open air which will be much appreciated. The sanitary arrangements and the ventilation of all the compartments have received very special attention, and will be found to be of the most up-to-date and satisfactory character a thorough system of mechanical ventilation having been introduced. Second-class accommodation has been provided in the poop, where a number of commodious state-rooms have been arranged at the sides of the vessel, with the dining-saloon in the centre of the vessel. In the after part of the shelter 'tween decks a space has been set apart for the accommodation of emigrants, while the crew are berthed at the fore end of the shelter deck. The captain's and officers' quarters are located in a steel house on the upper bridge deck convenient to the navigating bridge, while the engineers' and petty officers' rooms are placed along the starboard side of the vessel, on the upper deck, convenient to the engine room entrance. The four large holds into which the cargo space of the vessel is divided are almost entirely free from obstruction, the decks being supported by fore and aft girders in place of the usual system of hold pillaring; this arrangement affords ample space for the storage of the largest class of consignments, such as locomotives, railway carriages, boilers, while in anticipation of this class of cargo the hatchways have been constructed as large as possible. Each of the hatchways is equipped with four steam winches of the most powerful type, with a suitable number of derricks, capable of handling a full cargo in the most expeditious manner. The propelling machinery consists of a set of triple-expansion engines having all the latest improvements and a complete installation of auxiliaries, and supplied with steam from three steel cylindrical multitubular double-ended boilers. The construction of the vessel and machinery has been carried out under the supervision of the British Corporation Surveyors to qualify for the highest class in their Registry, while the requirements for a Board of Trade Passenger Certificate have also been fully complied with. The trials proved highly satisfactory, a speed of over 14 knots being attained on the measured mile. A number of guests were on board the vessel during the cruise, one of the owners' firm, Mr. Geo. Melly, being present; also Captain C. Bird, marine superintendent, and Mr. John Dall, engineer superintendent, who looked after the hull and machinery respectively during the construction.

Arabiana.—On December 21st, the steel screw steamer, *Arabiana* (of which we gave particulars in our December issue, page 195), built by Irvine's Shipbuilding and Dry Docks Co., Ltd., for the Furness Line, proceeded to sea for her trials. The ship and engines gave every satisfaction, a mean speed of 11 knots being attained.

Westwood.—On December 21st, the s.s. *Westwood* (of which we give particulars in this issue), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyard, Middlesbrough-on-Tees, for Messrs. Furness, Withy & Co., Ltd., West Hartlepool, proceeded to sea for her official trials.

Coltman.—Lately the steam trawler, *Coltman* (of which we gave particulars in our December issue, page 195), built by Earle's Shipbuilding and Engineering Co., Ltd., Hull, to the order of the City Steam Trawling Co., Ltd., Hull, had her official trial trip. The vessel left Victoria Dock, after coaling, on the early morning tide and anchored in the Roads, the officials and visitors boarding her at 9.45 a.m. when the anchor was weighed and she proceeded down the river. After adjusting compasses, the vessel was taken on a full speed run to Grimsby, which proved satisfactory to all concerned, the engines working easily, and the boiler developing ample steam pressure. After a successful trip, the vessel returned in time to berth in St. Andrew's Dock on the evening tide. The owners were represented by Mr. J. A. Laverack (managing director) and Mr. J. Watson (superintending engineer), and the builders by Messrs. J. L. Read and L. Cubley. There were also present on board Messrs. W. J. Stephenson, W. A. Simpson, J. Barclay (Lloyd's), F. Crawforth, W. Dale and Captain J. Gant, who will eventually take command. The *Coltman* is a sister vessel to the *Botanic*, which has had such a successful maiden voyage.

Messrs. Crosby, Lockwood & Son announce that they have opened at 121a, Victoria Street, Westminster, a West-End branch of their business, where a selection of new and standard technical publications will be kept on show.

Calendar.—We have received a Calendar for 1908 from the United States Metallic Packing Co., Bradford. The handsome design, artistically carried out in embossed work, is that of a girl's head in profile and is called "Our Matinée Girl."

Murray, Lotz & Co., of 102, Fenchurch Street, London, E.C., inform us that they have been appointed by the Partick Brass and Copper Works (A. Low), Glasgow, their sole agents for England and the Continent. This firm have a high reputation for radiators, tanks, sidelights, closets, and all sorts of brass and copper work used on board ship. They have fitted out a number of important vessels for merchants, as well as Government uses.

Milan International Exhibition, 1906.—The awards to the successful exhibitors at this Exhibition are to be distributed by his Excellency the Italian Ambassador at the Mansion House in London, on January 8th, 1908, the Right Hon. the Lord Mayor presiding. Amongst the successful firms are Wailes, Dove & Co., of Newcastle-on-Tyne, who have gained a Gold Medal for the excellence of their Patent "Bitumastic" Specialities, the same as were largely applied to the R.M.S. *Mauretania* and *Lusitania*.

Institute of Marine Engineers.—A Conversazione is being arranged for Friday, January 24th, in connection with the Institute of Marine Engineers, to be held in the King's Hall and Throne Room, Holborn Restaurant. The proceedings will open with a concert from 7 to 9, for which several well-known artistes have been engaged, and the remainder of the evening will be devoted to dancing music and other means of recreation being provided for those whose preference does not call them to the ball-room. The arrangements are under the direction of Mr. F. Cooper, and a large and enthusiastic gathering is anticipated.

The Marine Engineer

And Naval Architect.

LONDON, FEBRUARY 1, 1908.

THE NAVY ESTIMATES

SPECULATION is always rife about this time of the year in connection with the shipbuilding programme of the forthcoming Navy Estimates. Just now this is more than ever the case owing to the circumstance that more than one Foreign Power has apparently extended its programme further than was expected or allowed for in the Estimates for 1907-8 The feeling of incertitude aroused by this circumstance has been relieved to some extent by the utterances of several members of the Cabinet. Thus Sir Edward Grey, the Secretary of State for Foreign Affairs, speaking at Alnwick last month, said that if the programmes of foreigners were carried out in their entirety it would become necessary for us to increase the strength of our Navy; and although he thought there was no reason why we should rush hurriedly into increased expenditure, still we could not allow for a moment our relative naval strength to be impaired. Similarly Lord Tweedmouth, the First Lord of the Admiralty, speaking at Newcastle on the 23rd ult., insisted upon the need for making steady progress, keeping our eyes sharp on Foreign Powers, so as not to neglect any precaution. At the same time he spoke of the undesirableness of dashing suddenly into wild extended programmes, believing it to be more effective and at the same time more economical —as we could build at a greater rate in this country than in any other, and our capacities for warship building exceeded those of other nations—to wait until we made certain what they were going to do. And Mr. Lewis Harcourt, speaking at Bacup towards the end of January, put the matter still more clearly:

> Not only had we a Navy enormously larger than that of any other nation, but one greater than that of any combination which commonsense or sanity could conceive against us and we had in our dockyards and our private shipbuilding yards a power of production which was unequalled in the whole world Moreover, we had the capacity to produce battleships in a shorter time than any other nation Let another Power lay down a ship and make considerable progress, and we could then lay down our own probably on an improved design—with the certainty that ours could be floated before the other's was ready to leave the slips

The policy which is thus indicated is one which has much to recommend it, and it is that which as Sir William White explained in his letters on the subject to the *Times* in the beginning of last year, is the policy which has governed our shipbuilding programme in the past with most satisfactory results. As Mr. W. T. Stead has put it in the *Review of Reviews*, our formula must be to lay down two ships for every one that Germany lays down. But this is not to say that we are to lay down ships because a Foreign Power proclaims its intention of doing so. We can well afford to wait until we actually see what is being done, and then take those measures which are necessary to our security and essential to the maintenance of England's supremacy on the sea.

The satisfactory situation from a naval point of view in which we stand at present is largely due to the circumstance that the advent of the *Dreadnought* obliged all the Foreign Powers, and especially Germany, to pause in their shipbuilding activity, and to consider the bearing of the new factor upon the problem as it presented itself to each one of them. The result has been that every great Power has now followed our lead, and in the case of Germany this has meant an entire reconstruction, not only of her resources for shipbuilding and equipment, but of many other things beside, including the widening and deepening of the Kiel Canal. As a consequence, the two battleships of her programme for 1906 were not laid down until a twelve-month after date, *viz.*, in August last, and the two other battleships of larger displacement, belonging to the programme of 1907, were not laid down until late in last year; and as it is not contemplated in her programme that these ships should be completed in less than three years, it stands to reason that these four vessels are not likely to be ready for sea until the summer of 1910. A large cruiser of the *Invincible* type was laid down about the same time, and cannot be completed much before the battleships. Thus under the most favourable conditions, and putting on one side all the difficulties that must arise in connection with the construction and the provision of new armament for ships of novel design and unexampled size, Germany may have in 1910 a squadron of five ships embodying the *Dreadnought* principle. That it was in view of this circumstance that our own Estimates have been framed is made clear when it is remembered that by the same date we should have including the *Dreadnought* already built, the three *Bellerophons*, with the three *Invincibles*, in the water, and the three *St. Vincents* under construction ten ships embodying the *Dreadnought* principle to meet the German five. Moreover, we have a relative superiority in ships of the pre-*Dreadnought* period which is incontestable. It is, then, with the prospective German programme for 1908, consisting of three *Dreadnoughts* and one *Invincible*, that the Admiralty have to deal in framing the forthcoming Estimates. Even assuming that these ships are laid down this year, it is obvious that from the advantage we possess in building quicker there is no immediate need for haste, and much less for alarm. From Lord Tweedmouth's remarks at Newcastle, the Admiralty are evidently alive to the necessity of encouraging and supporting private enterprise in this direction, and providing that the advantages we

possess in the private shipbuilding firms are duly taken into account, as no doubt they will be, it should not be difficult in the programmes of this year and next to give a sufficient answer to Germany's challenge.

STOKEHOLD APPLIANCES

The paper on "Stokehold Appliances," read at the Institute of Marine Engineers on January 6th, raises several questions as to the possible improvements which might be made in connection with the marine boiler. There is room for a good mechanical stoker. Several attempts have been made to introduce one or other of the appliances which have proved successful in land boilers. Hitherto these attempts have not met with much encouragement, probably due chiefly to the different conditions and the consequent difficulties in the way of devising arrangements which will be simple in action under the varying circumstances of bunker position, level of firing platform and unstable base. The problem admits of solution, and we again commend it to the consideration of those whose forte it is to devise such appliances. The economy would well repay the fitting. The losses incidental to the combustion of fuel, even in the most complete installation of boilers, are very considerable, and in view of the ever-increasing price of coal every contrivance calculated to reduce these losses is worthy of careful consideration. The adoption of the cheaper varieties of fuel during recent years has led to more stringent regulations by port sanitary authorities on the subject of smoke emission within the precincts of harbours and rivers around the coast. But there is another aspect of the question worthy of attention and study from a chemical point of view: How can the carbon be consumed to better advantage and the products of combustion be used more perfectly and economically?

J. MACFARLANE GRAY

If the birth of a genius were known and proclaimed at the cradle and in the place of nativity, one is inclined to try to think out the probable result on the infant and the probable loss to the generations following his advent. That a genius has to grow up from infancy to youth unsuspected and unknown, to fight his own way and overcome the obstacles which beset his youth through life, is well both for the genius and the community in which his lot is to be cast. The genius of John Macfarlane Gray, whose portrait we give, was undoubted, and the circumstances under which he grew and developed tended to give him the very grit to enable him to come out pre-eminent in the special line of thinking he made his own. He had the root of the matter in him; the foundation of his education, although small, had a good base; he built upon it surely and consistently amid the deterring influences which surrounded him.

REVIEWS.

Elementari Schiffsahrtunde. Von Professor Dr. Bolte. Berlin: K. W. Meeklenburg, 1907.

This is the third volume of the series, and is by the editor himself upon navigation and its problems. The subject is treated scientifically. We see the action of the wind on the sails and the course the ship follows as a result. Rudder practice is followed by simple stability problems. Then we have charts presented of some of the German coasts. Such simple matters as the compass and logline precede the radius of action of lighthouses, which are followed by calculations giving the daily reckoning. Observations with the sextant are then explained with the horizon and what refraction means. The usual astronomical problems are then worked out, as well as some of the more intricate ones, the book finishing with various tables. This volume will be found of interest to all concerned, especially, perhaps, to teachers.

Bergen's Marine Engineer. 11th Edition. Edited by Thos. Southern. North Shields: W. J. Potts.

This is a manual for engineers preparing for first and second-class Board of Trade certificates. The work is prefaced by the elementary arithmetical principles, then follow three chapters dealing with the regulations, qualifications and conduct of the examinations. A general introduction covers a wide range of calculations in connection with mensuration and weights, work and power, flow of steam and water, and riveted joints, with methods of application to practical problems.

The main portion of the book is devoted to arithmetical questions, these are divided into groups of three sets of four examples as presented to the candidate at the examination, part being fully worked and part given with answers only, both for first and second-class. These give a comprehensive guide to the student of methods and formulæ for solution and provide a sufficient number of exercises to be worked; several blank pages are inserted for the recording of such questions as may from time to time come under notice.

Tables of areas and circumferences of circles and of hyp. logs are included, and a short resumé of the water gauge brings it into prominence with its possibilities of error and measures to guard against these.

The next portion contains the 310 elementary questions with answers clearly and concisely given, illustrated where necessary, and amplified by means of foot notes where a fuller description may be instructive. Several types of water-tube boilers are shown and the general arrangement of the Parsons turbine is illustrated, with a sectional view and indexed parts. The other newer questions are all dealt with, refrigeration being fully discussed, the newest specialties of feed-heaters, evaporators, and auxiliary pumps are described, electrical machines and distribution are widely covered, and this section is concluded with the principles and working of internal combustion engines.

The verbal questions and answers cover the parts of engines and boilers, their defects and repairs. A few pages are devoted to the analysing of valve settings by means of valve diagrams, and the work closes with a short treatise, fully illustrated, on indicator diagrams.

Attached is a small volume of working drawings of the principal parts of engines and boilers, fully dimensioned as far as required at the examination in this section. This is perhaps one of the best features of the publication, as the drawings are clear, of a convenient size, not complicated by unnecessary details or figures, and the greater number have specimen forms such as are required to be handed in by the candidate with his drawing.

In plate 28, a drawing of a screw propeller, we notice a trifling error by the substitution of "respectfully" for "respectively"; and in Question 90 of the Elementaries the definition of right and left hand propellers would be made clearer by the addition of fore and aft to the sketch, as "crank being on top centre" has no obvious meaning. Altogether the manual should form a ***vade mecum*** for the sea-going engineer and be fully as popularly received as have been its previous editions.

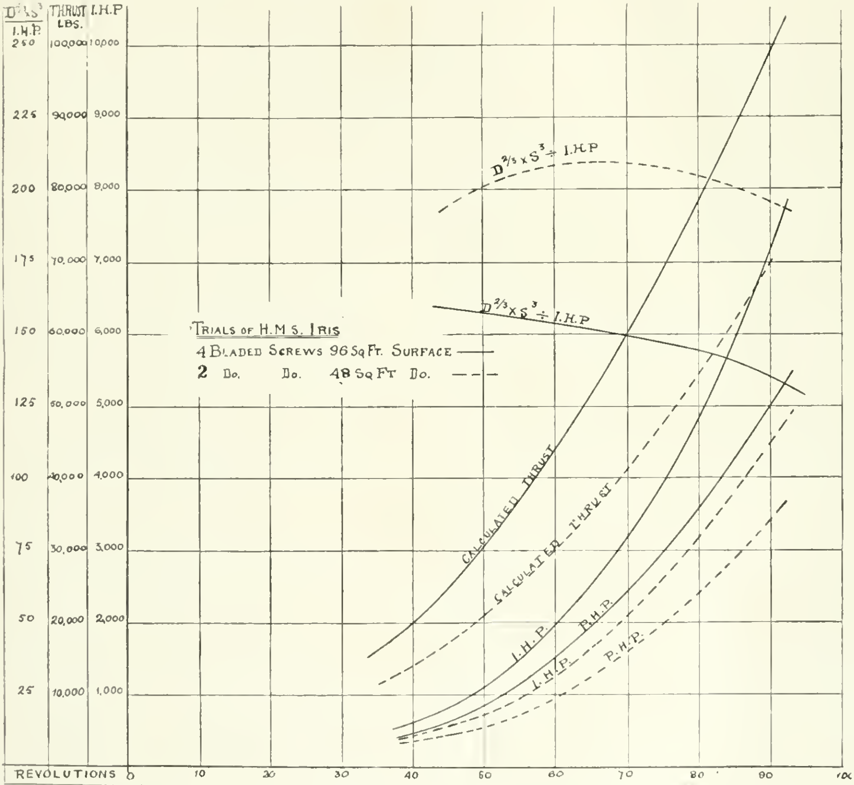
THE SCREW PROPELLER.

XVI.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

It has been suggested by an eminent writer on propellers that it is probable that the thrust from a screw depends on and actually varies directly with the amount of acting blade surface. This is both a bald and a bold statement to make, and certainly is one not borne out by the facts observed in such experiments as have been already given, nor is it in the propeller having only 8·9 sq. feet of surface gave more thrust than the one having double that area.

The same phenomena may be observed with the screws of the *Dwarf*, which had a pitch of 10·32 feet, and those having even 13·2 feet pitch followed on pretty much the same lines. In the cases cited the diameter and pitch of the screws have remained constant while only the surface has varied. It cannot of course be seriously maintained that *reduction* in area of blade surface is necessarily followed by *increase* in thrust as a rule, and hardly as an exception, unless it be clearly understood that with such reduction in



accordance with everyday modern experience in practice.

In the case of the *Dwarf* experiments given in Table XX., page 45, the thrust from the several propellers having a pitch of 8 feet was actually least with the one having the largest surface; not only was it so as given by the dynamometer, but also as calculated; and the thrust of that particular propeller with its 22·2 feet of surface was very little more than that given by the screw with 17·8 feet. Taking Bournes' Corrections of the dynamometer indications, surface an increase in revolution and consequent augmentation of I.H.P. has followed; with augmented horse power developed by the engine consequent on the increase in revolutions, there has been often an improvement in thrust. Moreover, under these conditions, the thrust is more efficient, inasmuch as there is less augmentation of resistance with the small screw than is common with large ones.

Had the writer alluded to limited his surmise to the statement that the thrust of propellers of the same diameter pitch and shape of blade will vary directly with the area of the acting surface of blades, less

* For Articles I. to XV. see previous issues.

objection could be taken to it, although it would even then have to be received with a certain amount of reserve. It is hardly possible to conceive that a screw propeller 10 feet in diameter with 18 feet pitch and 40 sq. feet of acting blade surface could produce the same thrust per revolution as one 15 feet diameter and 40 feet of surface and 18 feet pitch, although it is not difficult to understand that the latter would cause much more augmentation of resistance to the ship than the smaller one. If the blades of the original screw of H.M.S. *Iris* had been cropped so that the diameter was reduced to 16 feet and the surface from 97·2 sq. feet to 82 sq. feet, it is probable that the thrust would have been quite as much as given by her new screws, *viz.*, 98,280 lbs., with an augmentation of resistance of 18,000 lbs., as against the 101,240 lbs. of the original, with an augmentation of 37,290 lbs.

There are no actual experiments at hand with propellers having the same surface but of different diameters, but if reference is made to Table XXI., giving particulars of hypothetical screws, it will be seen that the thrust varies very largely although the blade surface is the same in all the cases. It must, however, not be taken as convincing proof, for besides being only hypothetical the engines were supposed to be allowed to develop different powers suitable to each screw as tried. It will be seen by reference to Table XXIII. that with H.M.S. *Diadem* and H.M.S. *Duncan* the variation in thrust certainly did not follow the variation in blade surface, nor did it in the case of the *Drake*; while in the case of the *Iris* the propeller with half the active surface developed an indicated thrust only 24 per cent. and the calculated thrust 14.3 per cent. less than that of the original screw with 97·2 sq. feet, while the speeds did not differ largely.

This latter case is so interesting and instructive that it is worth while looking into carefully. Fig. xxiii. shows the curves of I.H.P. calculated thrusts and propeller horse power of the two screws by taking revolutions per minute as a base instead of speed in knots per hour, for where the question under discussion is one of blade area a comparison of the performance of these two screws can be more usefully made in this way. It will be seen that roughly the thrust of the four-bladed screw is rather more than 40 per cent. higher than that from the two-bladed, that is to say, the thrust of the small is to the large as 1·0 to 1·42, consequently they vary in accordance with the square root of their respective areas.

Observations of the performance of other screws seem to confirm this relation, and as propellers generally appear to follow this law fairly closely it may be assumed that when all other things are alike they do so. This being so, the following may be used and the rules deduced therefrom taken as fairly accurate:

Rule I. The thrust of screw propellers varies, *pari passu*, with the square root of the area of the acting surface of blades.

From the same observations and investigations there is every reason to suppose that when the blade area and other particulars remain constant that

Rule II. The thrust also varies with the diameter of the screw.

It has already been intimated that the thrust is seriously affected by the pitch ratio; that the greater the ratio is the less is the thrust, hence within reasonable limits

Rule III. The thrust varies inversely as the pitch ratio.

It has also been shown that the thrust depends on the speed of the screw race per second (*vide* page 280), that is, a speed calculated by multiplying the pitch by the revolutions *per second;* Professor Cotterill has shown, as already stated, that to produce a solid column or the nearest approach to a solid column of water the shape of the blade must be somewhat similar to that of the common screw whose length was about one-eighth its diameter: The centre of gravity and centre of effort of the blade of such a screw would be farther removed from its axis than that of a Griffiths' or even that of a parallel-bladed screw. Hence it may be taken as certain that the thrust is seriously affected by the shape of the blade, so that while it is assumed that thrust varies with diameter a modification is necessary in the case of each screw, which shall provide for the variation in efficiency due to distribution of surface. It is probable that the *effective diameter* varies with that of the circle on which the centre of gravity of the blade surface lies less the diameter of the boss. Hence

Rule IV. The efficiency of a screw depends on the shape or distribution of the acting surface of the blades, and the thrust will vary according to the distance of the centre of figure from the outer surface of the boss.

Summing all these conditions the effective thrust of any propeller in pounds

$$T = \frac{D \times \sqrt{A} \times S^2}{R} \times f$$

where D is the diameter in feet.

A the total area of the acting surface in square feet.

S the speed of the screw's advance in feet per second.

R is the pitch ratio pitch ÷ diameter.

f is a multiplier—diameter of circle on which centre of gravity of blade figures lie less the diameter has of the boss. Its value is as follows:—

(*a*) Common screw .... $f = 0·52$ to 0.58
(*b*) Original Griffiths' .... $f = 0·45$
(*c*) Later ,, ... $f = 0·36$
(*d*) Leaf-shape blade .... $f = 0·40$
(*e*) Mercantile ordinary .... $f = 0·48$
(*f*) Circular blades .... $f = 0·45$

The old screws, both common and parallel-bladed, not only absorbed more of the torque in overcoming friction of surface, but produced considerable vibration in the ship, especially when only two-bladed, than was the case with the Griffiths screw. It is true Griffiths always supplied large bosses with his screws which would tend to keep down vibration, but his success was not due to this, for a common propeller was tried with a large spherical boss on H.M.S. *Conflict* in 1853, when a speed of 9·425 knots was maintained with 784 I.H.P., as against 812 I.H.P. with the common boss, so that the Admiralty co-efficient was improved from 140·8 to 154·5—the vibration still continued high. Except in the case of

very small screws, such as are necessary with launches and small craft going into very shallow water, the broad square-tipped screw was gradually dropped both in the Navy and Mercantile Marine, and now one rarely sees a "common" screw at all. The fine tips were first made common in the merchant ship with her three and four blades; the edges remain now as they were originally, *viz.*, "square," or rather they follow and are a segment of the circumference of their own circle, instead of being rounded to the shape of a leaf, as in H.M. Navy.

With the advent of the steam turbine as a motor, with its high revolutions to render it an efficient steam engine, has arisen the necessity for smallness of diameter; in such cases the necessary or rather the maximum surface is got by making the blades of circular form or rectangular with the angles well rounded off. The efficiency of such small propellers is necessarily low, but it is consequent on the high number of revolutions at which they are driven, and not to their shape of the blades.

LIVERPOOL MARINE ENGINEERS AND NAVAL ARCHITECTS.

THE ninth annual dinner of the Liverpool Marine Engineers and Naval Architects took place at the Exchange Station Hotel, Liverpool, on Saturday, Dec. 21st. It was presided over by Mr. Arthur J. Maginnis, a short account of whose career, with portrait, on page 283, will be of interest to our readers. The dinner was attended by over two hundred representatives of marine engineering, naval architecture and shipowners.

After the dinner, Mr. C. Herbert Birchall, in proposing "The steamship trade of Liverpool," said that that city had always led in the type of steamer that had helped to make England the foremost shipping nation of the world. It was to the naval architect and marine engineer that they owed the amazing developments which had taken place in the steamship construction; without them the enormous development in the trade of Liverpool would have been impossible.

Mr. Sidney Jones (Lamport & Holt), in responding, said that the past year marked an important epoch, for it was the 100th anniversary of the construction of the first steamship in the world; all honour to Fulton on the Claremont. What a change had taken place since that date; and what they owed to the naval architect and marine engineer during that period it would be impossible to say. Only the other day the *Lusitania* carried 4000 souls across the Atlantic to New York, and he did not think any of those people on board thought any more of the danger than they did of the danger of travelling through the city. Liverpool was dependent upon the naval architect and marine engineer for its very life. One hundred years ago the trade of the port was carried on by means of those white-sailed vessels which were dependent upon the wind for their navigation. Now, thanks to the naval architect, they were independent of wind and tide, and their steamers arrived and departed with almost clock-like regularity. He wished they had in Liverpool a medium exhibiting what had been done in the way of progress in naval architecture, say, from the time of the *Comet* up to the *Lusitania*.

Professor W. H. Watkinson proposed the next toast, that of "The Liverpool Marine Engineers and Naval Architects." Speaking of the great developments since the time of the *Comet* and *Susannah*, which have led to the construction of the steamships of which they were so proud to-day, he compared the present age with the Elizabethan. In the days of Good Queen Bess the enterprising discoverer had for his object the discovery of new lands. There was a finality in the discovery of new lands; but for the engineer, engaged in research for new moans of utilizing the forces of nature for the use of mankind, there was no limit. They had no sooner seen the triumph of the turbine, than they heard its displacement threatened by the internal combustion engine, of which research had led them to expect big possibilities. Scientific men throughout the wide world were mourning the loss of one of their greatest teachers, Lord Kelvin, an honorary member of their Liverpool Engineering Society. He (the speaker) had the privilege of being associated with his lordship as a student at Glasgow.

The Chairman, in responding, expressed the pride he felt that his own fellow-workers had placed him in the position of chairman of that gathering. Evidences of the skill and ingenuity of different persons present were to be found on steamships in every part of the world. Such gatherings were valuable for the interchange of opinion and the formation of friendship. Amongst their visitors were Mr. Young, of the Board of Trade, Mr. Williamson, of Lloyd's, and also representatives of the British Corporation.

In answer to the opinion that to be a good engineer one had to come from across the Tweed, there had been a time when all the leading positions were held by Scotchmen, but now he thought it was the turn of Ireland, who had produced that most eminent engineer and scientist who had just passed away. Again, it was to an engineer born in Tipperary that they owed the rotary engine, and to another noted Irishman the Hon. C. H. Parsons, the idea of the turbine, a model of which was first seen in the Liverpool Exhibition in 1884. Allusion had been made to the wondrous change in the civilization of the world, which had been brought about mainly by the work of the engineer and naval architect. It was thirty-five years since he had his first experience of the Atlantic ferry, and what a change since then! There were then seven or eight liners sailing from Liverpool, and the total horse-power, the carrying capacity and the total value was not equal to one of the present-day liners sailing out of the port. He believed it was Mr. Harry Grayson's idea that the society should form some provision to meet cases of distress. Meetings were held and a guild formed, and the amount promised and collected was £700. He would plead very earnestly that everyone present would do their best for the funds. In addition to the £700 they had a promised income from subscriptions of £69 per annum. Finally, they were all very grateful to their honorary secretary, Mr. C. Neilson, for the excellent arrangements of that evening.

Mr. J. Reney Smith proposed the toast of "Our Guests," which was responded to by Captain A. H. F. Young (Board of Trade), who referred to the function as one of the most pleasant of the year, and by Mr. R. Williamson (Lloyd's).

Mr. W. J. W. Bruce gave the toast "Our Chairman," to which suitable response was made.

The singing of "Auld Lang Syne" and "God Save the King" terminated a most successful gathering.

The Mersey Engine and Producer Co., Limited, of Liverpool, inform us that they have lately shipped a producer of 200 H.P. for marine purposes. This producer is for driving an engine of the vertical type. The advantages possessed by the combination they are confident will overcome all the prejudice marine engineers have against gas engines. In the first place, the producer can run continuously. The engine is reversed by simply throwing over a lever. The space occupied by it does not exceed that of a high-speed vertical marine engine, and the producer takes same space as a Scotch boiler. There is no objectionable smoke stack, the steaming range of the boat is doubled, or, in other words, the bunker capacity is reduced by half.

Bordeaux Maritime Exhibition, 1907. This exhibition, which was held in the summer of last year, was a great success. It was visited by the Institution of Naval Architects for their summer meetings, and there were many expressions of satisfaction from the members. The list of awards has now been issued, and amongst the successful exhibitors are Messrs. Wailes, Dove & Co. (1906), Ltd., of Newcastle-on-Tyne, who have been awarded gold medal and diploma for their exhibit of models of ship and iron buildings coated with their patent "Bitumastic" specialities. Messrs. Wailes, Dove & Co. also gained a gold medal at Milan International Exhibition for the excellence of their specialities.

Mr. Robert Matthews, of Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., Openshaw, Manchester, has just been appointed for the second time as the President of the Manchester District Engineering Trades Employers' Association.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Steamship Companies and Amalgamations.

COMBINATIONS, or at least working arrangements, between various shipping companies seem to be quite the order of the day. First, there is that most important combination of the two great German lines, the Hamburg-American Company and the Nord Deutscher Lloyd, by which these two lines will in future work in complete harmony, to, no doubt, the further detriment of British shipping interests. The heads of the two lines in combination will control a tonnage considerably in excess of the steam fleet of most countries in the world, for the total tonnage amounts to about one and two-thirds of millions of tons, contained in upwards of three hundred bottoms. Only three mercantile marines—Britain, Germany and the United States—can boast of so large a total as is here shown.

The arrangements made between these two companies, however, do not quite end the smoothing down of competition just achieved by the managers of the German lines, for at the time at which the Hamburg Company entered into this alliance with the Nord Deutscher Lloyd, that company was settling with another rival in the Far East—the powerful Yippon Ynsen Kaisha. Under these agreements the Nord Deutscher Lloyd attains, as far as it can from the other two contracting parties, a free hand in the Far East, for the Japanese Company withdraws from the trade to Singapore and the ports of China, leaving to the German line an opportunity to further develop the system which it commenced when it bought up the Scottish Oriental Company and the Holt Line, eight years ago. The Hamburg Company also undertakes to leave the China trade to the Bremen Company. On the Atlantic, the Nord Deutscher Lloyd is to devote itself to the improvement of the fast passenger trade, leaving, as far as possible, the Hamburg Company to deal with the large and increasing number of passengers who prefer less speedy vessels and greater space at sea. When it is remembered that the number of services maintained by these two companies cannot be far short of a hundred, it is apparent that there must hitherto have been a good deal of overlapping, so that the working arrangement now entered into will be almost certain to give, not only economy, but also a greater measure of efficiency in working to our German rivals.

Then is reported the amalgamation of the Thomson line, of Dundee with the Cairn line, which will now own a fleet of some nineteen vessels. The following are the particulars of the vessels taken over from Messrs. Thomson's :—

Ship.	Gross tonnage.	Year built.	Builder.	Place of build.
1. *Cervona*	3,779	1896	C. Connell & Co.	Glasgow
2. *Devona*	3,779	1896	C. Connell & Co.	Glasgow
3. *Latona*	4,338	1893	Sunderland S.B. Co.	Sunderland
4. *Hurona*	3,442	1892	Naval Construction Co.	Barrow
5. *Iona*	3,344	1892	Gourlay Bros.	Dundee
6. *Jacona*	2,969	1889	Sir Jas. Laing	Sunderland
7. *Fremona*	2,922	1887	Gourlay Bros.	Dundee
8. *Escalona*	1,835	1884	Gourlay Bros.	Dundee
9. *Bellona*	2,932	1881	Gourlay Bros.	Dundee

3. Formerly *Warrigal* of the Lund line. 6. Formerly *St. Marnock*, of Liverpool (Messrs. Rankin Gilmour & Co.) 9. Formerly *Hawley*, of Liverpool (Messrs. Williamson's).

Then Messrs. G. & J. Burns (Limited), of Glasgow—of which company Lord Inverclyde is chairman—have offered to purchase the Dublin and Glasgow Steam Packet Company. The offer made by the proposed purchasers was to exchange £54,000 five per cent preference shares in the Burns Company for the stock of the other line, which has a face value of £90,000. The shareholders in the latter company have tried but so far unsuccessfully, to obtain somewhat better terms from the proposed purchasers.

Finally, there is a working arrangement and interchange of capital between some of the important Italian Shipping Companies, including the Navigazione Generale Italiana—which takes the commanding part in the deal—the Italian Lloyd and La Veloce Italiana.

Disasters.

The *Principesa Jolanda*, the fine Italian steamship which careened and sank at her launch last year, is evidently now a total loss. The underwriters settled their liabilities some time ago on what appear to have been favourable terms—considering that she is a complete wreck—and now it is stated that the vessel, which at first lay with her side pretty well awash, has so far sunk into the sand that tugs can pass with safety over the spot on which she lies.

But foreigners are not the only people who have misfortunes at launches, though the accident to which I am about to refer did not amount to anything like a total loss. A fair-sized steamship, named the *Drake*, was launched at Troon in the last days of December for the General Steam Navigation Company. After leaving the ways in safety she put such a strain on the chains which had been provided to check her momentum that they snapped and the vessel, uncontrolled, rushed on to the breakwater and carried away her rudder and stern post, sustaining at the same time other damage which will delay her completion for some considerable time.

The Mount Royal.

At the latter end of December and the beginning of January there was much anxiety for the safety of the steamship *Mount Royal*, of the Canadian Pacific Railway's service. She left Antwerp for St. John, New Brunswick, on the 7th December, and was reported as passing the Lizard three days later. Thereafter came no news of her and it being known that bad weather had prevailed in the Atlantic on the 12th and 13th of the month, anxiety in respect of her increased, till at last as much as forty guineas was paid to effect re-insurances upon her. The Allan liner *Hungarian*, being also somewhat overdue, hopes were entertained that the *Mount Royal* had broken her shaft and was in tow of the other vessel. The *Hungarian*, however, turned up and simply added to the reports of bad weather, whilst she could bring no news of the overdue liner. But on the evening of the 6th January the *Mount Royal* herself was reported as being some 250 miles west of the Fastnet and steaming slowly to the eastward. Then at 10.30 a.m. on the 7th she anchored in safety at Queenstown, not having taken assistance. It appears that the steamer encountered exceedingly bad weather, and, as a result of the straining to which she was subjected, she was practically deprived of her power on the 20th December, when she had got as far on her voyage as lat. 49·30 N., long. 35·15 W. For another three days they were just able to keep the ship's head to the sea and then the power still failing she began to drift to the eastward. Captain Parcells rigged up what sail he could—the fore main and mizzen sails, three topsails and three trysails—and the five engineers headed by the chief, Mr. Swinburne, set to work to make good the defects, which fortunately were confined to the boilers. Their task cannot have been either easy or pleasant in such a sea, but they stuck manfully to it, and by the 26th the vessel was again able to use her engines. The captain, having the responsibility of the safety of some 550 persons, 350 passengers and about 200 crew, determined to put back to Queenstown, and thither the ship proceeded at a speed of some four or five knots. In Germany, both Captain Parcells and Mr. Swinburne would have received Imperial recognition for their services in this crisis, and that with the utmost promptitude. But we manage things otherwise in England, and, so far, the gentlemen in question have had no reward but the thanks of those whom they brought into safety, the applause of all who know anything of the circumstances and conditions under which they worked—and the satisfaction of having done their duty under most difficult and trying circumstances.

The "Suevic"

with a new bow, and practically as a new ship, has returned to the Australian service after an absence of about nine months. She sailed from Liverpool on her regular voyage on the 18th January under Captain Mathias. Amongst her cargo was a collection of live animals so varied that she has been described in the Press as a floating "Zoo."

at least four times as great as that to New York. Imagine the amount of coal which would be required to carry a high-speed vessel on such a trip. Her size would be impracticable, and she would increase the actual time occupied by the voyage owing to the greater distance to be traversed, unless she could actually double the rate of speed now given. But I need not waste more space in dealing with this obvious matter.

The Liverpool Underwriters' Association

has just issued its annual report. It is an interesting document and one which gives evidence of the thoroughness which characterises everything connected with the association. There is a résumé of the year's progress and the legislation connected with underwriting and shipping during the period under review, which is well worth preserving as a compendious and exhaustive record.

MR. ARTHUR J. MAGINNIS.

WE have the pleasure of giving in this issue a portrait of Mr. A. J. Maginnis, who presided at the annual dinner of the Liverpool Marine Engineers and Naval Architects. He is a native of the north of Ireland, and received his training in the service of Messrs. Harland & Wolff, Belfast. While serving his apprenticeship there the first fleet of White Star liners was built, and during this time he was much engaged in assisting Sir Edward Harland and Lord Pirrie, who was at that time their chief draughtsman.

After completing his articles Mr. Maginnis served as seagoing engineer for a short period in coasters, and afterwards on the White Star vessels then trading to the west coast of South America. Later he was appointed as Assistant Superintendent Engineer of the Line. This experience afterwards stood him in good stead, as his experience in cases of emergency trained him to prompt action under all circumstances when, later on, he became Superintendent Engineer of the British Shipowners' Atlantic and Colonial Steam Fleet. While holding the latter position he had the startling experience — in the early days of the use of steel— of the boilers of two steamers of 2,800 I.H.P. each practically falling to pieces, owing to the material having hardened and become brittle, so that the plates cracked.

After some years, Mr. Maginnis resigned his position as Superintendent Engineer to join as partner the London firm of Rait & Gardner, but after a few years he returned to Liverpool and commenced private practice as Consulting Engineer and Naval Architect.

Mr. Maginnis received the gold medal of the Institute of Naval Architects in 1879 for a paper on the screw propeller. He is one of the original members of the Liverpool Engineering Society, of which he was President in 1896, and has contributed several interesting papers bearing on steam shipping. He is also a member of the Institute of Marine Engineers, and had the honour of presenting the first paper to be read before that now flourishing Institution. The Liverpool Local Marine Board also claims him as an active member.

Photo by Messrs. Barraud, Liverpool.

Mr. Arthur J. Maginnis.

The Engineering Standards Committee.—The Lords Commissioners of the Admiralty have nominated Engineer Vice-Admiral H. J. Oram, C.B., as a member of the Sectional Committee on Sections and Tests for materials used in the construction of ships and their machinery, to fill the vacancy created by the retirement of Engineer Vice-Admiral Sir John Durston, K.C.B.

SOME REMARKS ON THE DESIGN, CONSTRUCTION AND WORKING OF THE MARINE BOILER.*

By Mr. Richard Hirst.

In bringing this paper before this Society the writer wishes it to be understood that it is not his intention to put forward anything novel, but simply give a few opinions upon the practice of boiler construction which has come under his notice during a long experience.

Boiler construction during the last twenty years has greatly improved, and has permitted the increased pressures now adopted. The improvement is due to the superior machinery available, the quality of steel as compared with iron, and the greater care taken in the workmanship, punching being now nearly a thing of the past, and drilling becoming almost the rule. In the old days boiler plates were made under the steam hammer from faggoted iron scrap, and as they were small, a much larger number had to be used in the building of a shell than is the case to-day. The introduction of heavy rolls has permitted a greatly increased width of the plates to be made (some mills being capable of rolling plates 13 feet wide, and of great length); very often a single-ended boiler shell is now made with only two plates in the shell. In the early days of thick shell plates it was the practice to heat them to a cherry red before bending, and in many instances the furnaces in the shops were not long enough to take in the whole length of the plate, therefore about three parts of the length would first be furnaced and the other part furnaced afterwards. One such instance caused a rupture in the shell at the point where the two heats met; the shell failed under the water test, and opened out about $\frac{3}{16}$-inch the full width of the plate. Cold bending was then resorted to in vertical rolls, and with less liability to any twist taking place in the bending or setting up strains by unequal heating. The first thick plates bent cold that came under my notice were bent in horizontal squeezers with concave and convex surfaces, great care having to be taken by marking off the parallel lines to avoid twisting, and in order that the butt joints should be fair.

On the introduction of the vertical rolls there was less chance of twisting, the rolls being set at right angles to the surface plates: large plates are very easily handled in most shops, and the great advantage of doing away with the centre seam and keeping the joints away from the boiler bottom tends to lengthen the life of the boiler. Vertical squeezers are now largely used. They permit the curvature being correctly made right up to the ends of the plate. This is not possible with rolls.

Where the width of the plate can be made to take the length of the boiler the butt straps are the same length, but in the case of double-ended boilers it is not so, and where the points have to be broken it is good practice to fit the straps under the next strake, taking the first or outer row of rivets in the circumferential seam. Some makers butt them up close to the next ring and fit an outside cleat or patch, which has an ugly appearance. Now with regard to the riveting: the percentage strength of the joint should be about equal, but any difference of strength ought to favour the riveting; *i.e.*, say the plate has the strength of 86%, the rivets should not be less than 87%, care being taken that the holes are full. A slight fin left beyond the heads, showing that no more metal could be got in the holes, is not an eye-sore, and a sure sign that long enough rivets are being used. When riveting shells under a hydraulic riveter they become hot at the part being riveted, and should be allowed to cool by turning the shell, and the work proceeded with at another part whilst the other portion is cooling, as by so doing sounder work will be obtained.

Where compensating rings have to be fitted, all such rings should be riveted on the shell before the holes are cut out, and this often prevents subsequent ruptures. All man hole doors should be a good fit in the apertures, in fact, as neat as a piston in a cylinder. The plates of the doors should be sufficiently thick to prevent buckling under pressure. The load on a 16-inch by 12-inch door at 160 lbs. is about 10½ tons. Where flanged necks and domes are fitted, care should be taken that the plates are of sufficient thickness to prevent any bending action. In a case which came under the writer's notice, when the valves were being adjusted, the dome moved on the neck portion quite readily owing to the thinning of the plate in flanging. Brackets were afterwards fitted to keep the dome in position.

When drain cocks or drain bolts are fitted, brass plates and plugs are not good for the plating, as they set up galvanic action and destroy the shell plating, and have been the cause of several men losing their lives. The big-headed bolt, fitted from the inside, made of iron and nutted outside, is the best drain arrangement.

When the end plates are flanged in the ordinary way, tightness under steam depends upon the flanging and plating where the lower fronts, tube and upper plates come together. Good fitting is necessary. If they could be turned in a lathe, good surfaces would be obtained; then if efficiently riveted in place, the less caulking will be required. End plates are left with much deeper flanges than used to be the practice. The advantage is a better attachment, as the circumferential seams at those parts are not so near the face of the ends, and can be much more readily caulked.

Flanges for furnace mouths are generally bored out true. This does not prevail everywhere, but there is no doubt that it improves the work. Tube plates when being drilled should have good smooth surfaces in the holes, and before being taken off the drilling machine each hole should have a coating of oil to prevent any rust depositing before the plates are used. The oil must be cleaned off before the tubes are rolled in. There are now a great number of styles of furnaces in use besides the original plain ones. These are made in several different ways, but the Fox, Morrison, and Deighton are first lap-welded in plain plates and afterwards corrugated in the rolls. Most of the other types are first ribbed or corrugated, and then bent in the circle and welded. In passing I would remark that the portion to be flanged should always be taken from the bottom part of the ingot, and when two plates are taken from one ingot the centre or nearest bottom portion is the flanged end, which, in some cases, is rolled an $\frac{1}{8}$ inch thicker at that end to allow for any wasting that may occur in flanging.

Some boilermakers weld the furnaces to the back tube plates, whilst others thin the tube plates at that point, more especially when the bottle-neck furnaces are fitted. As most of you are aware, some years ago a great number of furnaces failed at the back ends at the return flange. The writer was at that time instructed by the Committee of Lloyd's Register to visit the works of the different furnace-makers, with instructions to pay particular attention to the flanging process. It was then found that the radii at the corner and back ends were very small, so small in fact that the blacksmiths, to get them into the required shape, had to fuller them to such an extent and take heat upon heat that it was no wonder they failed and cracked under working conditions. Some of them were almost cut in two before leaving the several works. This was not the fault of the furnace-makers, but of the engineers who designed them. Failures at these particular corners are now a very rare occurrence.

More care is taken in the plating of the combustion chambers, and larger radii are used at the bends of the tops and sides than used to be the case. In some works, after flanging, the surfaces are either filed or ground at the corners, and sometimes over the whole of the flanged surfaces, taking out the hammer marks, and this brings the two surfaces much closer together, making sounder work possible.

The combustion chamber bottom plates should always be amply thick to allow for the wasting at those parts; doubling plates should never be fitted in combustion chamber bottoms. One case came under the writer's notice where the inside plate had buckled considerably between the rivets, while the lower or steam side plate had not altered its curve. The inner plate got overheated, and the steam had got between the two plates and set out the one on the fire side, with the result above mentioned.

It may not be out of place to describe how the tubes are made before dealing with the fitting of them. Strips of plates are rolled the requisite length and width, and are then bevelled on the edges at opposite sides. They are then furnaced, and when sufficiently hot are brought out and passed between two rolls, which are each grooved to the half circle, and work in a vertical position. The leading ends,

* Read before the Mersey Foremen Boilermakers' and Iron Shipbuilders' Association, Liverpool.

i.e., the ends that first enter the rolls, are partly folded inwards, and as the tube enters the roll it is received upon a mandrel, shaped somewhat like a boy's spinning top. The mandrel is about 6 inches long, and is placed just between the grooved rolls, and into the flat end is screwed a long rod, the tube being pushed over the mandrel. The weld is then completed the whole of the length by this one passage through the rolls. The tubes are then laid on surface plates and straightened or turned, such treatment being all that is required for making and fairing except cutting for length.

The Serve tubes are made in a similar way to the above description, with the exception that the ribs are rolled in the plates instead of being left plain. The ribs are on both surfaces until the last passage between the rolls, then the opposite rib is crushed into its fellow, which leaves one surface plain and the other ribbed. The reason that this method is adopted is because it would be impossible to commence at first with the plain and ribbed surfaces unless the provision was thus made for the surplus material that must accumulate between the ribs. The plates are then bevelled on the edges, and treated similar to the plain tubes, only the mandrel is grooved to receive the ribs. The process is not as simple as in the case of the plain tube, a number of them being spoiled when they were first being made by the men failing to catch the ribs direct into the grooves in the mandrel. Before fitting tubes into the boiler some firms grind the scale off both ends at the fitting parts, which is a good thing, bringing the surfaces closer together than would be if the scale was left on. All plain tubes should protrude sufficiently far through plates to admit of them being driven back when it may be necessary beyond the face of the back plate. Some makers bead them at the back ends, and others leave them plain. It is a matter of opinion which is the best, but when beaded over there is less surface for deposit.

Stays are now almost all made of steel. It is the writer's opinion that good iron is the best material for the screwed stays, but for the large stays steel is best. Less diameter and of course less weight is necessary than if made of iron. Taking first the large stays, it was difficult to keep them tight under steam when first high pressures came into practice, and very often they were screwed into both end plates. Again the holes were slightly countersunk, lead rings and cement filled in underneath the nuts, but what did more to prevent the leakage was the setting hard up of the inside nuts before hardening up the outside ones. Perhaps the best bar stays are those with the ends crushed up, the bottom of the screw threads being the same section as the body of the bar, care being taken that the inside nuts will slip along the bar without a great amount of dressing. Care should also be taken in screwing the ends as, unless the dies are good, steel crumbles and will not close the same as iron, very often leaving broken threads. Iron is, in my opinion, better than steel for the smaller stays, because I consider they are less liable to snap suddenly. They have a longer life, and the corrosion in iron is not so short and acute as in the case of steel. With the drilling and screwing machines now in use better work is done, and nothing looks better than even length of stays and protuberance not more than a thread through the nuts. Some firms insist on a very small hole being drilled in the end of the stays just beyond the thickness of the plates, as this acts as a tell-tale when the stay gives way, but of course all such work costs money. Girder stays should be fitted sufficiently clear of the tops and made to take both vertical and crown plates at the same time, and not project beyond the thickness of the vertical plates, where they prevent scaling by the overhang. When the boiler is subjected to the hydraulic test, care should be taken to let down the load gradually in pounds as it was put on, and not to take it off in tons, more damage being done by such sudden lightening of the load than twice the working pressure will ever cause. When subjecting boilers to test after repairs, one and a half working pressures is sufficient test to find any defective work that may exist. Where the pneumatic caulking machine can be used, neater work can be done, but with good plating less caulking is required, and the less the better.

Double-ended boilers, to suit certain conditions, are still frequently used, and are quick generators of steam, but in the past they have not been altogether a blessing, racking as they do the furnace ends, especially when the combustion chambers are common, causing the landing edges of the seam to crack from the rivet holes, and the flanges at the furnace ends to split. Separate combustion chambers are, in the writer's opinion, the best design, and less liable to rupture at the parts mentioned. When the end plates are flanged out the heel of the flanges should be set back; tighter work is obtained, as the plates are easily closed under the riveting machine.

With regard to double-ended boilers, when the punching of shell plates was general, and the pitching of the riveting not so carefully thought out, the plate section was often reduced to such an extent that the shell of these boilers very often split between the rivet holes, several such cases having come under the writer's notice. One instance was where the crack extended 8 feet 3 inches circumferentially, and was repaired as follows:—The rivet heads of the original seam were left in, but cut off flush and closed as far as possible, and the square edge of the landing bevelled away; a large joggled plate curved to about an inch less radius than the boiler bottom, lapping the seam about 1 foot each edge, was fitted, with a single row of rivets at each edge about 4 inches pitch, and when fitted it was pumped up with a solution of boiled oil and lead. The boiler bottom was not otherwise disturbed. By cutting out the defective plate the boiler would have been considerably weakened. Such repairs have never given trouble excepting where the bottoms have been cut out. Front and back end seams when flanged outwards often waste through leakage, and can be made tight if sufficiently high to get a blow at the rivets. First cut out the original rivets, and dress the edges of the plates as far as practicable, and then bend a round bar the same diameter as the thickness of the end shell plates to the same radius as the boiler; flange the plate to the shape of the moulded bar, thus stepping the rib of the seam, and make the plate sufficiently wide to take hold of the boiler bottom and end plate—say for a distance about one foot vertically on the back end, and the seam longitudinally on the shell. Longer rivets will be required, but the new rivets in the patch will form part of the circumferential seam. Smaller rivets can be used at the edges of the patch, and this has been proved an effective repair. When the ends are flanged inward in the ordinary way, and wasting of plates and rivets has taken place, making it necessary to cut out the fronts, scarphed landings are better than butt straps, and should be double riveted if possible. The wasting of front ends is usual in boilers placed too low, through the cooling out of ashes when cleaning fires, the flanged plates being more vulnerable to corrosion than plates which have not been worked in the fire. Wasted rivets in the bottom of the circumferential seams are often found to be worst at the back of the seams, the heads facing the man hole being as good as the day they were put in. This is caused by heavy iron rakes being dragged over the heads when the dirt and deposit is being cleaned out, and therefore wooden rakes should be used. It must not be forgotten, however, that one great advantage of the Scotch boiler is the room in the bottom for deposit.

We find furnaces pitted the worst at the line of the bars. This is due in some instances to narrow water spaces, but very often to neglect in keeping them clean, causing them to crack. Doubling used to be common in such cases with plain furnaces, and this not only increased the liability to further cracking, but always meant renewal of furnaces. Where half-angle bars are fitted too high and the ends come into the bed of the fire the same thing happens. The furnaces split away from the rivet holes of the angle bars. Where it is possible to repair a damaged plain furnace the patch should be fitted on the fire side, so that when it is renewed in most cases the same size of patch will do. When they are fitted on the steam side the landing edge of the furnace is burnt away, and this means a bigger patch at each repair. Few of the patent furnaces can be repaired with any satisfaction.

Combustion chambers waste more at the bottoms and lower back ends, and this is due to the deposit left in when the boilers have been blown down. Instances have occurred of such wasting due to the feed water impinging on the upper backs and sides, and frequently around the necks of the stays small cavities of corrosion will often be found. It has often occurred to the writer that a great deal of this corrosion could be prevented if the combustion chamber bottoms were cleared of the hot deposit when the boilers were blown down or run out. Grooving is sometimes found at the landing edges of combustion chambers, and one such case recently

was the cause of all the combustion chamber having to be entirely renewed. The deep centre boxes were fitted in three plates, and the wings in two at the backs, whilst the sides were fitted in two plates, and the bottoms each with one plate, care being taken that the landing edges of the riveted seams were placed so as not to catch the flame. Every screwed stay was renewed. These repairs were done without taking out any of the furnaces or tubes, the boilers being single-ended. In another case of repairs to a double-ended boiler which had been leaking so badly that the vessel was towed in from sea, the writer found the flanged corners at the furnace ends sprung to such an extent that he could insert his fingers. The firebox was common to both ends, and all the rivets at the sides were leaking, and a great number loose. The tube plates were buckled and the tube holes oval, some of them ¼-inch, and the crown plates were buckled. This case was repaired by cutting out all the tubes, rivets, crown stays, and plates, the latter being badly buckled. Spectacle tube plates were made with holes larger than in the original, and all the holes in the tube plates were faired. This was done to prevent the rosebits getting away from the truth. The crown plates and all the riveting were renewed, as were the ordinary and stay tubes. This repair was done without cutting out the furnaces.

In the raising and lowering of steam pressures, time and care should be taken. All grease and fatty matter should be prevented from entering the boiler, and all scale preventing and cleaning compounds avoided. Leakage, be it ever so small, often gives trouble, and the writer has a case in mind, when the compound engine was first introduced, of an able engineer who had been used to the jet condensing engines having drilled small holes about $\frac{3}{16}$-inch diameter opposite the port in the blow-down cocks. By so doing he thought to avoid scumming by opening the cocks in the usual way. The result was that at the end of a long voyage he found the boilers just like salt pans, and all the backs buckled and the tubes leaking. In another case six Cornish land boilers, which were fed from a tank into which several factory engines exhausted, the furnace of the one nearest the tank collapsed with 10 inches of water in the glass. When the boiler was blown out nothing but a fine dust was observable. The boiler was put into use again, and the furnace collapsed as before. It was then decided to cut off the feed tank, with the result that there was no further trouble. This clearly proved that the fine dust which was first seen must have been highly charged with grease. The majority of cases where furnaces have collapsed are due to greasy deposit, and in many instances have occurred after the boilers have been under banked fires. They are caused by the grease settling on the furnaces, which had previously been held in suspension when under steam. It is the writer's opinion that frequent washing out of boilers, the use of zinc plates, common soda, and sometimes a small quantity of lime, will keep a boiler healthy.

Patches have recently been fitted to boilers by means of electric welding, known as oxy-acetylene process. Mr. Ruck Keene a colleague of mine, has read a paper on the system. This form of repair may accomplish what ordinary caulking cannot cure, but, in my opinion, boilers treated by such a process must always be regarded with a certain amount of suspicion and should be kept under very careful observation.

R.M.S.P. "ASTURIAS."

ON the 24th January last, the magnificently appointed twin-screw Royal Mail Steam Packet Co.'s liner *Asturias* sailed from Tilbury on her maiden voyage to Australia. We have already given a full description of the vessel in our November issue, and the present article will be devoted to a short description of the machinery etc. The *Asturias* is 520 ft. long between perpendiculars, moulded breadth, 62 ft., and has a depth of 36 ft., with a gross register tonnage of 12,[illegible] from which it will be seen that she is one of the largest vessels to leave the port of London.

The main propelling machinery consists of twin sets of quadruple-expansion direct-acting inverted cylinder "balanced" engines. The diameters of the cylinders in each set are as follows H.P. 27 in.; I.P'. 38½ in.; I.P. 55 in. and L.P. 79½ in. with a stroke of 54 in. The engines are capable of developing 8,000 I.H.P. United States Metallic Packing is fitted to the H.P. and I.P'. piston rods and valve spindles.

Steam is supplied at 215 lbs. per square inch by three double and four single-ended boilers working under natural draught. There are six furnaces in each double-ended boiler and 3 in each single-ended boiler, which gives a total of thirty furnaces.

Each furnace is fitted with Messrs. Railton Campbell and Crawford's patent rocking fire bars and Silley's patent smokebox doors are fitted throughout. These doors are daily coming more into favour and 192 doors were fitted in each of the new Cunarders.

There are two stokeholds and in order to deal with the ashes, two Sees' ash ejectors are fitted, one in each stokehold. Messrs Railton & Campbell have also supplied one of their patent ash hoists.

The auxiliary machinery comprises twin main feed pumps and hot-well tank by Messrs. Weir, a Quiggin's feed heater, 45-ton evaporator and distiller, Edmiston filter, Woodison boiler feeding pump, fresh-water and sanitary pumps of Messrs. Carruthers' make. Messrs. Harland & Wolff have supplied and fitted a winch condenser, with separate air and circulating pumps. There is also a large duplex Marine Type carbonic anhydride refrigerating machine driven by compound surface condensing engines with two Co^2 evaporators and two Co^2 condensers. This has been supplied by Messrs. J. & E. Hall, of Dartford, Kent, together with a complete set of electrically welded brine grids for the various cold chambers, and the vessel can carry a large refrigerated cargo and has very large refrigerated chambers for ship's provisions, together with cupboard coolers for wines and iced drinks.

This machinery is placed between the shaft tunnels and occupies very little space. Forward of this machinery is an automatic, compound condensing, vertical pumping engine, by Messrs. Brown Bros., of Edinburgh, which supplies water at a pressure of 1,000 lbs. per square inch to work the ten hydraulic cranes with which the vessel is equipped. These cranes are noiseless in action and thus do not disturb the comfort of passengers.

Messrs. W. H. Allen, Son & Co., of Bedford, have installed complete systems of electric light, and bells throughout the vessel—four sets of compound direct-acting vertical steam engines, direct coupled to multipolar continuous current generators, supply the necessary current for lighting, and ventilating the vessel.

Each first and second-class cabin is supplied with a ventilating fan. These have been supplied by Messrs. Bergtheil & Young and are controlled by switches which allow of the fan being run at three different speeds.

An electric elevator, by Messrs. Waygood & Co., serves five decks and communicates with the dining saloon and up to the social hall.

The galley is replete with all the latest machinery and fittings which are associated with a first-class modern hotel and comprises bain marie hot-water boilers, dough troughs, hot presses, electrically driven dish washers and roasters, and Messrs. Wilson & Co. have fitted their well-known ovens, etc.

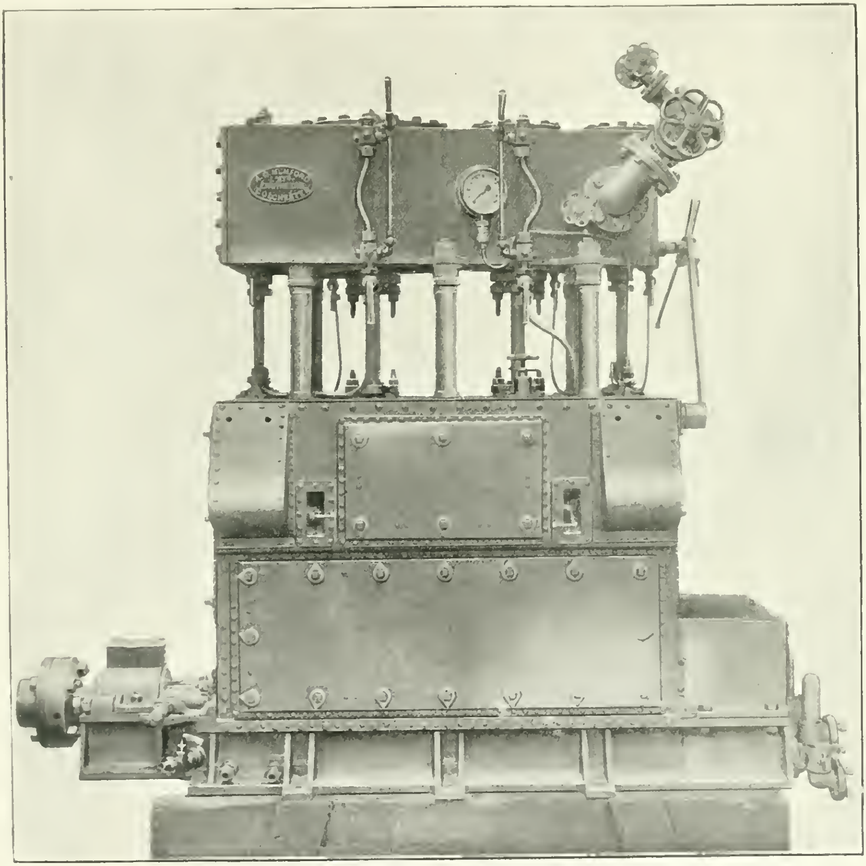
There is also an electrically driven laundry on the poop, which is fully equipped with all the latest type laundry machinery, comprising electric hand irons, etc.

In order to minimise the great risk of fire, Messrs. Clayton and Co. have fitted a complete installation for fire-annihilating purposes, comprising their patent, electrically driven, fire-extinguishing plant, from which mains are led to the various compartments, and through which the fire-annihilating gas is forced to the seat of the fire, thus effectually extinguishing it without causing damage to cargo, fittings, etc., such as is consequent upon the use of water.

From the above outline description of the main, and auxiliary machinery, it will be seen what a vast amount of detail comes under the charge of the engineering staff on a vessel like the *Asturias*, which represents the type of vessel of which the Royal Mail Steam Packet Co. now have a fleet of five, which are known as the "A Class."

Holzapfel's Compositions Company, Limited, have elected Mr. O. Levin and Mr. T. M. Little, both of whom have been connected with their business for over twenty years, to seats on their board.

From the days when Boadicea raised the standard of independence, goaded to desperation by the treatment meted out to her family and friends, to the days of the present is a far cry and the contrast is fruitful of thought to the student of history and of the changes recorded by the historians. The Colchester of to-day is founded on the Camalodunum of the past, the scene of the retribution which overtook the Romans at the hands of the enraged Queen of the Iceni, but who, alas, was afterwards overwhelmed by the trained cohorts of Rome. As a visiting-place for a day off or a Saturday afternoon, which allows of just sufficient time to whet the appetite for more the town, famous for possessing within its outskirts a resting-place for the bivalve dear to the palate of the connoisseur, is full of interest and affords opportunity for many different tastes to be satisfied. The old Roman walls and the ancient vessels preserved in the museum appeal to one whose proclivities lie in the line of thought which hovers around method and order, two elements manifested yet in our day as a legacy from the Roman legions and the policy of their leaders the main arteries of the land and the foundation of our law and government. It is said that in Colchester the distinguished personality well known and admired in the late Chas. H. Spurgeon first saw the glimmering of that light which beamed from him with such effect. Turning to more prosaic, but not less interesting, material, we may record our impressions of the modern equipments of the town to commend it as moving onward in relation to trade and commerce, which have become more and more the criterion of excellence in the every-day world. There are several engineering and other works carried on in the neighbourhood; the largest that of Messrs. Davey Paxman & Co., the well known firm of engineers and boilermakers, we hope to have the privilege of visiting on a future occasion; meantime, we were favoured with an entry into the works of Messrs. Mumford, a name which is known to marine engineers far and wide for the special pumps, as also for pumps of different types, of which the Mumford "Cameron" is deservedly popular for its steady action and sturdy appearance. With the introduction of the brine system of refrigeration came the need for a reliable brine pump and here Messrs. Mumford specialized to make one suited to the purpose and succeeded. The works are self-contained, the foundry, smithy, erecting and finishing shops are compact and well fitted, while the boiler shop shows ample evidence



High-Speed Marine Engine with forced lubrication. Messrs A G Mumford, Limited, Colchester

of a large turnover. While pumps are the speciality which one is accustomed to associate with the name of the firm, the excellent and neatly finished marine engines for launches and small craft compel attention and admiration; not less so do the special water-tube and other boilers in various stages of construction. Another speciality which has of more recent years been introduced to our engine-rooms, the surface-condensing plant to deal with the exhaust steam from the auxiliaries, is made at these works, also the combined air and circulating pump. A photograph of a set of high-speed marine machinery working under forced lubrication is reproduced herewith, eight sets of which have recently been completed for the British Admiralty. These engines have cylinders 6 in. and 12 in. in diameter by 8 in. stroke, and develop about 130 I.H.P. when running at about 580 revolutions per minute with steam of boiler pressure 185 lbs. per square inch, the steam being generated in the patent water tube type of boiler working in closed stokehold under forced draught. The engines are entirely enclosed, the whole of the moving parts being lubricated under pressure, the oil for which is pumped from a well in the bedplate (the bedplate being of box form, with solid bottom and sides) into the main bearings, from which it is taken by means of grooves in the brasses and holes drilled in the crank-shaft, crank webs, crank-pins, etc., to the crank-heads and eccentric straps, and thence by means of pipes to the crossheads, eccentric rod pins, link blocks, links, etc., the eccentric sheaves being machined out of a solid forging with the crankshaft.

A special feature of interest in connection with this design is the fact that the piston rods are lengthened to ensure no part of the rod which enters the steam cylinder entering into the oil chamber, this being adopted in order to prevent the possibility of oil being carried to the boilers by creeping up the piston rods, a desideratum not always considered in this class of engine as it ought to be.

In addition to the eight sets referred to, similar machinery has been fitted in the two steam boats for the Russian cruiser *Rurik*, now building by Messrs. Vickers, Sons & Maxim; there are also on order several sets of slightly larger size to develop about 160 H.P..

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Devonport Dockyard.

It is now definitely stated that the *Collingwood* will be officially commenced on February 3rd. The keel has already been placed in position, and the slip on which the vessel is to be constructed presents a scene of great activity. Hundreds of tons of material have been delivered and much of this has been taken to the slip. This procedure has been adopted with all the battleships built here of late years but never before has the work reached such an advanced stage before a ship has been officially laid down. As in the case of the *Bellerophon* and the *Téméraire* a month will again divide the commencement of the new ships at this yard and at Portsmouth. It is expected that Mrs. Barlow, the wife of Vice-Admiral Barlow, the Admiral Superintendent, will perform the ceremony of laying the keel plate. Talking of Admiral Barlow reminds me that he will be leaving us at the end of March, when he completes two years. The reason of his not staying three years, which is the usual period, is that he has been promoted to Vice-Admiral since he came here, and it has been decided that officers of that rank shall only hold such posts for two years, so as to give the junior flag officers a chance of employment. His successor will be Rear Admiral Cross, who commanded the Reserve Division at this port a couple of years ago. The gun and torpedo trials of the cruiser *Minotaur* are expected to take place on February 16th, but this will depend on the progress made with the closing up of the machinery after the examination following the completion of her steam trials. The vessel is ordered to be out of dockyard hands by the end of March. After being commissioned she will proceed to Bantry for calibrating tests, and she will be one of the first ships to use the new ranges there. A couple of months ago I mentioned that the battleship *Cæsar* had lost a propeller blade. That has now been replaced. In consequence of the loss a thorough examination was made of the propeller fittings, including the main shafts, which were removed to permit of the metal lining being sighted. A flaw in the lining of the starboard shaft near the stern gland was found, and this has also been made good. While the vessel is in dock her fire control and wireless apparatus are being brought up to date and her ventilation equipment improved. The battleship *Russell*, of the Atlantic Fleet, came to this port to give Christmas leave, but she is staying longer than was expected for the purpose of having her magazine fitted with cooling apparatus. As the vessel is to undergo a complete refit a couple of months hence it was expected that the work would be postponed until that time. Overtime has been worked in order to get the work done with as little delay as possible. The searchlight equipment of the battleship *Mars* is being improved by the mounting of two additional projectors, this bringing the number up to eight. The cruiser *Cornwall*, which has been thoroughly refitted to prepare her for her new duties as training ship for cadets, has left for a six months' cruise, during which she will visit Gibraltar, Madeira, the West Indies, Nova Scotia and Canada. This is a great improvement on shore training, for the lads will be quite seasoned salts by the time they return home in July. The *Argyll* came in just before Christmas for a refit, and she is to be ready to rejoin the First Cruiser Squadron by February 4th. The cruiser *Niobe*, flagship of Rear-Admiral Denison, commanding the local division of the Home Fleet, has completed her refit. The fleet, which has been strengthened by the commissioning of the cruiser *Gibraltar* on January 4th, will shortly go for its first cruise under its new commander. A few days before Christmas the destroyers *Lee* and *Fairy* came into collision. The *Lee* was entering and the *Fairy* was leaving the new tidal basin and the impact was sufficient to start a number of rivets in the bows of the former vessel. The two thirty-five-year-old gunboats *Badger* and *Snap*, which have been employed for so long as tenders to the *Vivid*, were paid off on January 5th, and two days later the sloop *Rinaldo* was commissioned at Sheerness to perform the duties. The *Rinaldo* has not yet arrived here. Torpedo boat No. 99 is still in dock, but nothing has up to the present been done to her. The vessel, it may be remembered, sank off Berry Head six months ago and was raised and towed here in two pieces. It was stated that the Admiralty had decided that she should be refitted or rebuilt, but it is doubtful whether it will pay to make the vessel fit for further service. The construction of an oil-fuel depot at Turnchapel is to be commenced at once. It will provide storage for 30,000 tons of liquid fuel, and ample provision will be made for further expansion. Messrs. Relf & Sons, of Plymouth, are the contractors, and the work is to be completed in two years. Engineer Rear-Admiral North is a fortunate officer. Only promoted from Engineer Captain on the staff of the Admiral commanding the Home Fleet, at Portsmouth, a couple of months ago, he has now succeeded Engineer Rear-Admiral Robins on the staff of the Commander-in-Chief at this port. It is not often that an officer obtains a post so soon after promotion. Another interesting appointment is that of Commander Preston, who has taken command of the local torpedo boat flotilla. He was promoted last June for the assistance which he rendered when commanding the destroyer *Bruizer* on the occasion of the *Ariel* being wrecked on Malta Breakwater in April, when he was thanked by the Commander-in-Chief of the Mediterranean Fleet for his splendid feat of seamanship.

Portsmouth Dockyard.

The keel of our new battleship the *St. Vincent* was laid on December 30th by Mrs. Robinson, the wife of the Admiral Superintendent. Those at the ceremony were, in addition to Vice-Admiral and Mrs. Robinson, Mr. Marshall, the Director of Dockyards, Engineer Rear-Admiral Corner, and Mr. Apsey, the manager of the Constructive Department. The keel plate, which was 25 ft. long by 3 ft. wide, and weighed over a ton, having been lowered into position, Mrs. Robinson tapped the rivets at the corners and declared the keel "well and truly laid." As a souvenir of the occasion Mr. Apsey presented to Mrs. Robinson an inkstand, which took the form of a model of the keel plate. The *St. Vincent* will displace 19,200 tons, and she is to have a speed of 22 knots. The first consignment of turbines have arrived for the *Bellerophon* from the Fairfield Shipbuilding and Engineering Company,

and are being put into the vessel. Various minor improvements are to be introduced, including an alteration in the shape of the fore funnel. It has been found that the *Dreadnought's* fore funnel, which has flat sides and circular ends, holds the wind too much. The *Bellrophon's* is, therefore, to be elliptical, but the after funnel will be circular. The *Dreadnought* arrived at Spithead on December 28th from Gibraltar, and two days later was brought into the dockyard and berthed alongside the South Railway Jetty. Several defects are being made good, and I understand the vessel remains here until the first week in February. The new steering engines and the new propellers proved satisfactory, while during gunnery practice the ship proved herself an excellent gun platform in rough weather. The officers speak highly of the seagoing qualities of the vessel, which were rather severely tested by the bad weather met with on the voyage home. The new battleship *Lord Nelson* arrived at Spithead from Jarrow on January 13th to carry out her gun trials. She is commanded by Captain Sir Robert Arbuthnot. The battleship *Prince George*, flagship of Rear-Admiral Farquhar, has had the damage done to her by the *Shannon* made good, and she also underwent a thorough overhaul while in dock. She was undocked and placed at her moorings in the stream on January 15th. Lord Charles Beresford's flagship, the *King Edward VII.*, has been taken in hand, but only absolutely necessary work is to be done, this including the bringing up to date of her wireless installation and fitting her with wireless telephones, with which I understand all the newest battleships are to be equipped. The *Drake*, flagship of Rear-Admiral Adair, commanding the Second Cruiser Squadron, which came to Portsmouth to give Christmas leave, on the passage from Gibraltar carried out an eight hours' full power trial at an average of 23·9 knots per hour. The *Drake* has always been a good steamer. In the race of the squadron across the Atlantic a couple of years ago on the conclusion of the visit to the United States, she was an easy first at Gibraltar. In December, 1906, she averaged 22·5 knots on a thirty hours' run, but her best recorded speed is 24·8 knots. On February 1st the crew of the scout *Foresight* is to proceed to Haulbowline to commission the cruiser *Philomel*, which has undergone a thorough refit at the Irish yard. She is a third-class cruiser, built in 1890, and before going to Haulbowline was for some time lying at moorings in the Firth of Forth with a number of other non-effective vessels. After commissioning she will come here to be completed to full crew for service in the Mediterranean to relieve the *Venus*, which joins the Channel Fleet. I hear that experiments with high explosives are to be carried out in the old battleship *Colossus* under the supervision of a committee which has been investigating the best means of storage. The battleship *Vengeance* and the cruiser *Ariadne*, with four destroyers, proceeded to Torbay on January 8th, where they carried out some important trials with new fire control instruments under the supervision of Admiral-of-the-Fleet Sir Arthur Wilson, V.C. The gunboats *Mastiff* and *Arrow*, which have been attached to the Gunnery Establishment for some time as tenders, are to be paid off on February 1st. To take up their duties the sloop *Vestal* was commissioned at Sheerness at the beginning of January. The vessel has undergone extensive alterations and has been mounted with a new armament, consisting of four 4-inch and four three-pounder quick-firing guns. It is quite time that the Gunnery School had more up-to-date tenders than the two old gunboats, which were built as far back as 1871. They will most likely figure in the next sale of obsolete vessels. We had a foreign visitor to spend Christmas at Portsmouth in the shape of the Italian warship *Regina Elena*, commanded by the Duke of the Abruzzi. The officers visited the dockyard, the Gunnery School at Whale Island, the Royal Naval Barracks, and the torpedo school-ship *Vernon*, while the Admiral-Superintendent entertained the Duke to dinner. Entertainments were provided by the townsfolk for the crew, who appear to have had a very good time. The Duke was quite pleased with the reception, and before the vessel left on January 5th for Cherbourg he sent a letter of thanks to the Commander-in-Chief, Admiral Sir Day Bosanquet.

Chatham Dockyard.

The statement as to the dredging of the river Medway seems to have been somewhat exaggerated. Mr. Lamb, the member for Rochester, has had an interview with the Admiralty, and he has been given to understand that the dredging is not to extend much above the sand bar at Sheerness, and that it is in order to make the Black Stakes capable of holding the Home Fleet. Mr. Lamb also states that no definite sum has been allocated for the work. I reported the return of the cruiser *Shannon* from her trials last month. The results obtained appear to have been highly satisfactory. The vessel being fitted with the latest improvements to her four 9·2 in. and ten 7·5 in. gun mountings, the gun trials were of a most important and interesting nature. The machinery went through the various trials without the slightest hitch. On the eight hours' full-power trial the engines developed over 20,000 horse power, and attained a mean speed of 22·417 knots with a mean consumption of coal of only 2·1 lb. Even better results would doubtless have been obtained had the weather not been so rough. The machinery of the vessel is now being opened up, and when this is completed she will be prepared for her acceptance trials. Before she proceeds to sea again her funnels may be heightened. They are much lower than those in many other cruisers, and possess some disadvantages. The cooling of the magazines is also to be undertaken. The repairs of the battleship *Bulwark* having been completed, she proceeded on January 16th to Sheerness to rejoin the Home Fleet, this allowing the *Magnificent* to come in for her refit, which is to be completed by April 20th. The *Bulwark*, it may be remembered, was damaged by stranding on the Leman Bank, off Yarmouth. It was found necessary to remove nine plates between the keel and the fore part of the bilge on the starboard side, and six of them were replaced by new ones. While she was in hand her magazines were fitted with coolers. The total cost of the refit will be about £8000. The *Achilles* and *Natal*, which had been here for about six weeks, left at the end of the first week of January to rejoin the Fifth Cruiser Squadron for a fortnight's cruise, on the conclusion of which the flagship *Leviathan* and the *Cochrane* came in for their refits. The battleship *Majestic*, of the Nore Home Fleet, will complete her refit on January 31st, and next day will go to Sheerness to resume her duties until relieved by the new battleship *Agamemnon*, which is completing at the works of Messrs. Beardmore & Company, Dalmuir. The *Majestic* will then proceed to Devonport to rejoin the Home Fleet at that port. The cruiser *Amphitrite*, which belongs to the Devonport Division of the Home Fleet, arrived here from Colombo a few days before Christmas with the paid-off crew of the *Kent*, of the China Squadron. She left again on January 16th for the same destination with a new crew for the cruiser *Monmouth*. It seems a good idea to make use of the vessels of the Home Fleet in this manner. The destroyer *Orwell*, of the Permanent Flotilla, which was damaged during the exercises in the North Sea, had to put in to Leith, where she was repaired. She returned here on New Year's Day and has now joined the Home Fleet Flotilla.

Sheerness Dockyard.

We are at present busy with destroyer refits and our prospects for some time to come are very good. Ten vessels of the Permanent Flotilla are in hand, and they are to be completed by the end of February. The sloops *Vestal* and *Rinaldo*, which have been fitted for service as gunnery ships, were commissioned on January 7th, the former as tender to the Portsmouth Gunnery Establishment and the latter as tender to the Devonport Gunnery School. The vessels are now having their armament put on board, and they will shortly leave to take up their new duties. The two sloops present a far different appearance now from what they did when they hoisted the pennant for service on the China station, which, by the way, was the only service they ever did before being put on the non-effective list. They then had three masts, the fore and mainmast having yards, whereas they have now two pole masts. There is now only the steamship *Isla* in hand, in addition to torpedo craft and submarines. The *Isla* is being fitted for service as an oil-carrying vessel, and extensive alterations are to be made to fit her for her new duties, including storage tanks, etc. The new dockyard tug *Robust*, which has arrived from the works of Messrs. Bow, MacLachlan & Company, of Paisley, will be a valuable addition to the yard craft. The tug was built for service at Gibraltar, but her services not now being required there she has been sent here for duty. The battle-

of a large turnover. While pumps are the speciality which one is accustomed to associate with the name of the firm, the excellent and neatly finished marine engines for launches and small craft compel attention and admiration; not less so do the special water-tube and other boilers in various stages of construction. Another speciality which has of more recent years been introduced to our engine-rooms, the surface-condensing plant to deal with the exhaust steam from the auxiliaries, is made at these works, also the combined air and circulating pump. A photograph of a set of high-speed marine machinery working under forced lubrication is reproduced herewith, eight sets of which have recently been completed for the British Admiralty. These engines have cylinders 6 in. and 12 in. in diameter by 8 in. stroke, and develop about 130 I.H.P. when running at about 580 revolutions per minute with steam of boiler pressure 185 lbs. per square inch, the steam being generated in the patent water tube type of boiler working in closed stokehold under forced draught. The engines are entirely enclosed, the whole of the moving parts being lubricated under pressure, the oil for which is pumped from a well in the bedplate (the bedplate being of box form, with solid bottom and sides) into the main bearings, from which it is taken by means of grooves in the brasses and holes drilled in the crank-shaft, crank webs, crank-pins, etc., to the crank-heads and eccentric straps, and thence by means of pipes to the crossheads, eccentric rod pins, link blocks, links, etc., the eccentric sheaves being machined out of a solid forging with the crankshaft.

A special feature of interest in connection with this design is the fact that the piston rods are lengthened to ensure no part of the rod which enters the steam cylinder entering into the oil chamber, this being adopted in order to prevent the possibility of oil being carried to the boilers by creeping up the piston rods, a desideratum not always considered in this class of engine as it ought to be.

In addition to the eight sets referred to, similar machinery has been fitted in the two steam boats for the Russian cruiser *Rurik*, now building by Messrs. Vickers, Sons & Maxim; there are also on order several sets of slightly larger size to develop about 160 H.P..

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondents.)

Devonport Dockyard.

It is now definitely stated that the *Collingwood* will be officially commenced on February 3rd. The keel has already been placed in position, and the slip on which the vessel is to be constructed presents a scene of great activity. Hundreds of tons of material have been delivered and much of this has been taken to the slip. This procedure has been adopted with all the battleships built here of late years, but never before has the work reached such an advanced stage before a ship has been officially laid down. As in the case of the *Bellerophon* and the *Téméraire* a month will again divide the commencement of the new ships at this yard and at Portsmouth. It is expected that Mrs. Barlow, the wife of Vice-Admiral Barlow, the Admiral Superintendent, will perform the ceremony of laying the keel plate. Talking of Admiral Barlow reminds me that he will be leaving us at the end of March, when he completes two years. The reason of his not staying three years, which is the usual period, is that he has been promoted to Vice-Admiral since he came here, and it has been decided that officers of that rank shall only hold such posts for two years, so as to give the junior flag officers a chance of employment. His successor will be Rear Admiral Cross, who commanded the Reserve Division at this port a couple of years ago. The gun and torpedo trials of the cruiser *Minotaur* are expected to take place on February 10th, but this will depend on the progress made with the closing up of the machinery after the examination following the completion of her steam trials. The vessel is ordered to be out of dockyard hands by the end of March. After being commissioned she will proceed to Bantry for calibrating tests, and she will be one of the first ships to use the new ranges there. A couple of months ago I mentioned that the battleship *Cæsar* had lost a propeller blade. That has now been replaced. In consequence of the loss a thorough examination was made of the propeller fittings, including the main shafts, which were removed to permit of the metal lining being sighted. A flaw in the lining of the starboard shaft near the stern gland was found, and this has also been made good. While the vessel is in dock her fire control and wireless apparatus are being brought up to date and her ventilation equipment improved. The battleship *Russell*, of the Atlantic Fleet, came to this port to give Christmas leave, but she is staying longer than was expected for the purpose of having her magazine fitted with cooling apparatus. As the vessel is to undergo a complete refit a couple of months hence it was expected that the work would be postponed until that time. Overtime has been worked in order to get the work done with as little delay as possible. The searchlight equipment of the battleship *Mars* is being improved by the mounting of two additional projectors, this bringing the number up to eight. The cruiser *Cornwall*, which has been thoroughly refitted to prepare her for her new duties as training ship for cadets, has left for a six months' cruise, during which she will visit Gibraltar, Madeira, the West Indies, Nova Scotia and Canada. This is a great improvement on shore training, for the lads will be quite seasoned salts by the time they return home in July. The *Argyll* came in just before Christmas for a refit, and she is to be ready to rejoin the First Cruiser Squadron by February 4th. The cruiser *Niobe*, flagship of Rear-Admiral Denison, commanding the local division of the Home Fleet, has completed her refit. The fleet, which has been strengthened by the commissioning of the cruiser *Gibraltar* on January 4th, will shortly go for its first cruise under its new commander. A few days before Christmas the destroyers *Lee* and *Fairy* came into collision. The *Lee* was entering and the *Fairy* was leaving the new tidal basin and the impact was sufficient to start a number of rivets in the bows of the former vessel. The two thirty-five-year-old gunboats *Badger* and *Snap*, which have been employed for so long as tenders to the *Vivid*, were paid off on January 5th, and two days later the sloop *Rinaldo* was commissioned at Sheerness to perform the duties. The *Rinaldo* has not yet arrived here. Torpedo boat No. 99 is still in dock, but nothing has up to the present been done to her. The vessel, it may be remembered, sank off Berry Head six months ago and was raised and towed here in two pieces. It was stated that the Admiralty had decided that she should be refitted or rebuilt, but it is doubtful whether it will pay to make the vessel fit for further service. The construction of an oil-fuel depot at Turnchapel is to be commenced at once. It will provide storage for 30,000 tons of liquid fuel, and ample provision will be made for further expansion. Messrs. Relf & Sons, of Plymouth, are the contractors, and the work is to be completed in two years. Engineer Rear-Admiral North is a fortunate officer. Only promoted from Engineer Captain on the staff of the Admiral commanding the Home Fleet, at Portsmouth, a couple of months ago, he has now succeeded Engineer Rear-Admiral Robins on the staff of the Commander-in-Chief at this port. It is not often that an officer obtains a post so soon after promotion. Another interesting appointment is that of Commander Preston, who has taken command of the local torpedo boat flotilla. He was promoted last June for the assistance which he rendered when commanding the destroyer *Bruizer* on the occasion of the *Ariel* being wrecked on Malta Breakwater in April, when he was thanked by the Commander-in-Chief of the Mediterranean Fleet for his splendid feat of seamanship.

Portsmouth Dockyard.

The keel of our new battleship the *St. Vincent* was laid on December 30th by Mrs. Robinson, the wife of the Admiral Superintendent. Those at the ceremony were, in addition to Vice-Admiral and Mrs. Robinson, Mr. Marshall, the Director of Dockyards, Engineer Rear Admiral Corner, and Mr. Apsey, the manager of the Constructive Department. The keel plate, which was 25 ft. long by 3 ft. wide, and weighed over a ton, having been lowered into position, Mrs. Robinson tapped the rivets at the corners and declared the keel "well and truly laid." As a souvenir of the occasion Mr. Apsey presented to Mrs. Robinson an inkstand, which took the form of a model of the keel plate. The *St. Vincent* will displace 19,200 tons, and she is to have a speed of 22 knots. The first consignment of turbines have arrived for the *Bellerophon* from the Fairfield Shipbuilding and Engineering Company,

and are being put into the vessel. Various minor improvements are to be introduced, including an alteration in the shape of the fore funnel. It has been found that the *Dreadnought's* fore funnel, which has flat sides and circular ends, holds the wind too much. The *Bellrophon's* is, therefore, to be elliptical, but the after funnel will be circular. The *Dreadnought* arrived at Spithead on December 28th from Gibraltar, and two days later was brought into the dockyard and berthed alongside the South Railway Jetty. Several defects are being made good, and I understand the vessel remains here until the first week in February. The new steering engines and the new propellers proved satisfactory, while during gunnery practice the ship proved herself an excellent gun platform in rough weather. The officers speak highly of the seagoing qualities of the vessel, which were rather severely tested by the bad weather met with on the voyage home. The new battleship *Lord Nelson* arrived at Spithead from Jarrow on January 13th to carry out her gun trials. She is commanded by Captain Sir Robert Arbuthnot. The battleship *Prince George*, flagship of Rear-Admiral Farquhar, has had the damage done to her by the *Shannon* made good, and she also underwent a thorough overhaul while in dock. She was undocked and placed at her moorings in the stream on January 15th. Lord Charles Beresford's flagship, the *King Edward VII.*, has been taken in hand, but only absolutely necessary work is to be done, this including the bringing up to date of her wireless installation and fitting her with wireless telephones, with which I understand all the newest battleships are to be equipped. The *Drake*, flagship of Rear-Admiral Adair, commanding the Second Cruiser Squadron, which came to Portsmouth to give Christmas leave, on the passage from Gibraltar carried out an eight hours' full power trial at an average of 23·9 knots per hour. The *Drake* has always been a good steamer. In the race of the squadron across the Atlantic a couple of years ago on the conclusion of the visit to the United States, she was an easy first at Gibraltar. In December, 1906, she averaged 22·5 knots on a thirty hours' run, but her best recorded speed is 24·8 knots. On February 1st the crew of the scout *Foresight* is to proceed to Haulbowline to commission the cruiser *Philomel*, which has undergone a thorough refit at the Irish yard. She is a third-class cruiser, built in 1890, and before going to Haulbowline was for some time lying at moorings in the Firth of Forth with a number of other non-effective vessels. After commissioning she will come here to be completed to full crew for service in the Mediterranean to relieve the *Venus*, which joins the Channel Fleet. I hear that experiments with high explosives are to be carried out in the old battleship *Colossus* under the supervision of a committee which has been investigating the best means of storage. The battleship *Vengeance* and the cruiser *Ariadne*, with four destroyers, proceeded to Torbay on January 8th, where they carried out some important trials with new fire control instruments under the supervision of Admiral-of-the-Fleet Sir Arthur Wilson, V.C. The gunboats *Mastiff* and *Arrow*, which have been attached to the Gunnery Establishment for some time as tenders, are to be paid off on February 1st. To take up their duties the sloop *Vestal* was commissioned at Sheerness at the beginning of January. The vessel has undergone extensive alterations and has been mounted with a new armament, consisting of four 4-inch and four three-pounder quick-firing guns. It is quite time that the Gunnery School had more up-to-date tenders than the two old gunboats, which were built as far back as 1871. They will most likely figure in the next sale of obsolete vessels. We had a foreign visitor to spend Christmas at Portsmouth in the shape of the Italian warship *Regina Elena*, commanded by the Duke of the Abruzzi. The officers visited the dockyard, the Gunnery School at Whale Island, the Royal Naval Barracks, and the torpedo school-ship *Vernon*, while the Admiral-Superintendent entertained the Duke to dinner. Entertainments were provided by the townsfolk for the crew, who appear to have had a very good time. The Duke was quite pleased with the reception, and before the vessel left on January 5th for Cherbourg he sent a letter of thanks to the Commander-in-Chief, Admiral Sir Day Bosanquet.

Chatham Dockyard.

The statement as to the dredging of the river Medway seems to have been somewhat exaggerated. Mr. Lamb, the member for Rochester, has had an interview with the Admiralty, and he has been given to understand that the dredging is not to extend much above the sand bar at Sheerness, and that it is in order to make the Black Stakes capable of holding the Home Fleet. Mr. Lamb also states that no definite sum has been allocated for the work. I reported the return of the cruiser *Shannon* from her trials last month. The results obtained appear to have been highly satisfactory. The vessel being fitted with the latest improvements to her four 9·2 in. and ten 7·5 in. gun mountings, the gun trials were of a most important and interesting nature. The machinery went through the various trials without the slightest hitch. On the eight hours' full-power trial the engines developed over 20,000 horse power, and attained a mean speed of 22·417 knots with a mean consumption of coal of only 2·1 lb. Even better results would doubtless have been obtained had the weather not been so rough. The machinery of the vessel is now being opened up, and when this is completed she will be prepared for her acceptance trials. Before she proceeds to sea again her funnels may be heightened. They are much lower than those in many other cruisers, and possess some disadvantages. The cooling of the magazines is also to be undertaken. The repairs of the battleship *Bulwark* having been completed, she proceeded on January 16th to Sheerness to rejoin the Home Fleet, this allowing the *Magnificent* to come in for her refit, which is to be completed by April 20th. The *Bulwark*, it may be remembered, was damaged by stranding on the Leman Bank, off Yarmouth. It was found necessary to remove nine plates between the keel and the fore part of the bilge on the starboard side, and six of them were replaced by new ones. While she was in hand her magazines were fitted with coolers. The total cost of the refit will be about £8000. The *Achilles* and *Natal*, which had been here for about six weeks, left at the end of the first week of January to rejoin the Fifth Cruiser Squadron for a fortnight's cruise, on the conclusion of which the flagship *Leviathan* and the *Cochrane* came in for their refits. The battleship *Majestic*, of the Nore Home Fleet, will complete her refit on January 31st, and next day will go to Sheerness to resume her duties until relieved by the new battleship *Agamemnon*, which is completing at the works of Messrs. Beardmore & Company, Dalmuir. The *Majestic* will then proceed to Devonport to rejoin the Home Fleet at that port. The cruiser *Amphitrite*, which belongs to the Devonport Division of the Home Fleet, arrived here from Colombo a few days before Christmas with the paid-off crew of the *Kent*, of the China Squadron. She left again on January 16th for the same destination with a new crew for the cruiser *Monmouth*. It seems a good idea to make use of the vessels of the Home Fleet in this manner. The destroyer *Orwell*, of the Permanent Flotilla, which was damaged during the exercises in the North Sea, had to put in to Leith, where she was repaired. She returned here on New Year's Day and has now joined the Home Fleet Flotilla.

Sheerness Dockyard.

We are at present busy with destroyer refits and our prospects for some time to come are very good. Ten vessels of the Permanent Flotilla are in hand, and they are to be completed by the end of February. The sloops *Vestal* and *Rinaldo*, which have been fitted for service as gunnery ships, were commissioned on January 7th, the former as tender to the Portsmouth Gunnery Establishment and the latter as tender to the Devonport Gunnery School. The vessels are now having their armament put on board, and they will shortly leave to take up their new duties. The two sloops present a far different appearance now from what they did when they hoisted the pennant for service on the China station, which, by the way, was the only service they ever did before being put on the non-effective list. They then had three masts, the fore and mainmast having yards, whereas they have now two pole masts. There is now only the steamship *Isla* in hand, in addition to torpedo craft and submarines. The *Isla* is being fitted for service as an oil-carrying vessel, and extensive alterations are to be made to fit her for her new duties, including storage tanks, etc. The new dockyard tug *Robust*, which has arrived from the works of Messrs. Bow, MacLachlan & Company, of Paisley, will be a valuable addition to the yard craft. The tug was built for service at Gibraltar, but her services not now being required there she has been sent here for duty. The battle-

ship *Trafalgar*, tender to the Gunnery School, has been shifted from No. 21 buoy to No. 3 in order that the moorings may be taken up, examined, strengthened and relaid in readiness for the *Dreadnought*, which is shortly expected to arrive from Portsmouth to take up her duties as flagship of Vice-Admiral Sir Francis Bridgeman the Commander-in-Chief of the Home Fleet. The admiral, I should imagine will be glad when his proper flagship does arrive, for he has been constantly changing his flag from one vessel to another lately. Indeed, half the ships of the Nore Division of the Home Fleet have been his flagship at one time or another. Your Portsmouth correspondent referred to the repair ship *Cyclops* and the destroyer *Fawn* last month. In connection with that incident the Commander-in-Chief has signified to Captain Foot, of the *Cyclops*, that after consideration of the report of the proceedings of that vessel when towing the *Fawn* from Invergordon to Portsmouth, he noted "with satisfaction the behaviour of the ships' companies of both vessels during the heavy weather experienced, which reflects great credit on all concerned. I desire you to read this memo to the officers and ship's company of the *Cyclops*." The vessel has now joined the Nore Home Fleet. Rear-Admiral Sir Percy Scott's First Cruiser Squadron unexpectedly remained here to give Christmas leave and did not leave until the middle of January, when the vessels returned to the Longsands Range for battle practice. Our Captain-Superintendent, Captain Casement, has been unexpectedly promoted to Rear-Admiral, curiously enough by the retirement of a former Captain-Superintendent of Chatham Dockyard, Rear-Admiral Kirby, who was promoted to flag rank when at Chatham in 1905, since when I believe he has been unemployed. Rear Admiral Casement who only came here in May, will probably stay for a few weeks, as at the time of writing his successor has not yet been appointed. In connection with the departure of the German Emperor and Empress from this port, Lieutenant Munro, the assistant to the commander of the yard and King's harbour master, has had conferred upon him by the Emperor the Order of the Royal Crown of Prussia. Mr. Shrubsall, the deputy King's harbour master, has also been awarded a silver medal in recognition of his services in piloting the Imperial yacht *Hohenzollern*. Only two of the bodies of the eight men who were drowned by the capsizing of the *Speedwell's* pinnace have been recovered. At the inquest evidence was given to show that the accident was due to pure misadventure and to the extraordinary weather which prevailed at the time, and also that fourteen was a fair load. The jury returned a verdict that the men were accidentally drowned, and added that they were of opinion that, having regard to the condition of the weather, the boat was overloaded.

Pembroke Dockyard.

At the end of December two more gangs of shipwrights were transferred from the cruiser *Defence* to the *Boadicea*. It is probable that this has been done not only to expedite the new vessel, but also to absorb the remainder of the £30,000 allowed for labour on the hull, fittings and equipment before the financial year comes to an end. Preparations have been in progress which would appear to indicate that the vessel will be launched at an early date, and from what I can see, however, it will be near the end of March or the beginning of April before the vessel takes the water. Excellent progress is being made and the staff of Messrs. John Brown & Company, the engineer contractors have arrived and are busy with their operations. The armament of the *Defence* is arriving. Just before Christmas the naval ordnance steamer *Bison* brought from the works of Messrs. Vickers, Sons & Maxim, Barrow-in-Furness four 9·2 inch B.L. guns and four 12-pounder (18 cwt.) Q.F. guns. A week later the steamship *Hadley* came from Barrow with four 7·5 inch B.L. gun houses and gun mountings. Six of the ten 7·5 inch gun houses and accessories with which the ship will be equipped have now been delivered, but none of the guns of that calibre have yet been received. The four 9·2 inch guns which constitute the main armament will be mounted in pairs in barbettes, one on the forecastle deck and the other on the upper deck aft. The gun houses and the two guns for the after barbette are already in position. The destroyer *Express*, which put in here on December 7th in a crippled condition, left after a month's stay for Portland to rejoin the Channel Fleet Flotilla. The damage to the vessel, which resulted from a collision with the depot ship *Aquarius* at Lamlash, necessitated the removal and substitution of two plates. Her port propeller was broken and the tail and piece of propeller shafting on the port side bent. Two new propellers also had to be fitted. Had the *Express* been a modern destroyer instead of a vessel eight years old we should have had to send to another yard for the plates, and this would necessarily have delayed the repairs. Mild steel plates however, were suitable, and luckily we had plenty of these in hand of the requisite thickness. It is certain that unless an alteration is made with regard to keeping material on hand serious inconvenience will result some time or other. The torpedo gunboat *Halcyon* and the coastguard cruiser *Thrush* have arrived here to be refitted. Both are very small vessels, and the amount which will probably be spent in refitting them will not be much more than £2500 for the two, roughly divided as follows: £1400 for labour, £700 for materials, £200 for contract work, and the same amount for incidental charges. That is what their last refits amounted to. However, the work is very welcome small as it is. The outlook for the next financial year is not particularly promising, for I hear that their Lordships desire the expenditure on wages to be kept as low as possible during 1908-9. Therefore, before expressing an opinion or venturing a forecast as to future prospects it will be as well to await developments.

H.M.S. "TARTAR."

H.M.S. *Tartar*, built throughout by Messrs. John I. Thornycroft & Co., Ltd., at their works opposite Southampton Docks, particulars of whose trials we gave in our last issue, is 270 feet long, beam 26 feet, and draught 9 feet 10 inches, and the hull is built principally of high-tensile steel so constructed as to obtain the maximum of strength with the minimum amount of material.

The turbines, which are of about 14,500 I.H.P., are supplied with steam from six Thornycroft water-tube boilers arranged for burning oil fuel. The fuel used is a heavy oil which is injected by means of special burners of Admiralty pattern. The working pressure is 220 lbs. per square inch.

The special advantages due to the use of oil fuel are very apparent in the illustration which depicts the *Tartar* running at 34½ knots. The absence of smoke is very noticeable, this being due to the perfect control of the air supply, sufficient only being admitted to ensure complete combustion. The annoyance and danger due to small ashes falling about the decks is entirely obviated by the use of oil fuel, and the speed can be reduced almost instantly, which is a very important consideration. Flaming at the funnels is also entirely absent.

The vessel is equipped with a wireless telegraph apparatus and loud-speaking telephones are fitted to all the principal stations throughout the ship.

Messrs. Thornycroft are at present building a slightly larger destroyer, the *Amazon*, and since the trial of the *Tartar* have received an order for a second *Amazon*.

Fig. 1 is from a photograph of the interior of the engine-room and illustrates the starting platform and the arrangement of steam valves, steam and oil pressure gauges, telegraphs, counters, etc.

ELECTRICITY ON BOARD SHIP.

XV.*

By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc. M.I.C.E., etc.

Arc Lamps—General Construction.

ARC lamps are employed for search lights, and for loading and unloading cargo. The lamps employed for the two series are alike in principle, and also in construction up to a certain point. With the search light, the object to be attained is the production of a very brilliant, sometimes blinding, beam of light, that can be turned in any direction, and that is confined to a certain limited area. With cargo lights the object to be attained is the provision of a good light, over a certain area, the deck, the hatchways, part of the holds, the ship's side, and the wharf, or dock to or from which cargo is being handled. There are broad distinctions between the construction of the two forms of lamps to meet these requirements. The cargo light must burn continuously, while cargo is being handled, and must be able to be turned in and out at will, while it is in its place, without the necessity of much attention to the lamp itself. The search light, on the other hand, is worked entirely by an attendant, in the great majority of cases, and it is not often allowed to be in operation unless there is a skilled man alongside it.

The Principle of the Arc Lamp.

The principle upon which all arc lamps are worked is the same as that which leads to trouble with badly designed switches, to the dirtying of contacts of telegraph keys, and bell and other pushes; but instead of the phenomena being a nuisance, it is made use of. The principle is as follows. Whenever a current is passing in a circuit, and the circuit is broken, a spark passes across the break, and if there is sufficient energy behind it, an arc or bridge of flame and hot gases is set up between the two ends of the conductors where the break occurred. With a switch, this leads to the burning of the contacts, and the destruction of the working parts. In an arc lamp the break of the current is made to take place between the ends of two carbon rods, arranged for the purpose. Usually the two rods are arranged vertically, one above the other, the lower one being held in a frame that is sometimes fixed, and sometimes movable, the upper one being always held in a movable frame, or holder. Usually also the bottom end of the upper carbon rests upon the top end of the lower carbon, though in a few lamps, known as shunt lamps, the ends of the carbons are apart, when at rest. In either case, the carbons are together when the current is first passed through the lamp, and they are separated by the action of an electro magnet, worked by the same current that is to furnish the light or the equivalent. When the ends of the carbons separate, a spark passes between them, and if all is in order, this is followed by an arc, or bridge, of flame between them. With continuous currents, which so far have only been employed on board ship, the arc is formed by the passage of minute particles of carbon from the positive carbon to the negative, and by a stream of gas in the same direction. At the end of the positive carbon very intense heat is developed, resulting in the conversion of a certain quantity of the carbon into vapour, thus forming the bridge of gas referred to above. A minute crater is also formed in the end of the positive carbon, which acts as a reflector, throwing the rays downwards. For this reason, in some forms of arc lamps used for search lights, the carbons are fixed horizontally. Both of the carbons burn away, the formation of the gas at the positive carbon being responsible for a large portion of the consumption and oxidation of both carbons, owing to the intense heat, for nearly all the remainder. There is also a deposit of very finely divided carbon, on the end of the negative carbon, this being a portion of the gaseous matter sent out from the positive carbon.

The end of the positive carbon assumes the form of a blunt point, with the minute crater referred to in the end, the negative carbon having a sharp point at the end.

With alternate currents both the carbons are alternately positive and negative, and hence there is a small crater formed in the end of each, and both are also pointed. The two carbons assume a form that is a compromise between the blunt point of the positive and the sharp point of the negative with continuous currents. The light furnished by an arc lamp supplied with alternate currents is thrown both up and down, if the carbons are held vertically, and to right and left, if they are horizontal. For search-lights, as will be seen, where the arc is required to be kept in the focus of the system of lenses and reflectors provided for it, the alternate current should be more suitable than the continuous current. For cargo lighting the continuous current is the best, as the light is always required below the lamp, which may be conveniently triced up out of the way of the hoisting tackle. If any cases occur, however, where men are required to work about the masts, etc., at night, the alternate current arc may be useful under certain conditions, provided its light can be kept out of the eyes of the men. On shore the continuous current arc is preferred for street and similar lighting, because of its rays being thrown downwards.

The Mechanism of Arc Lamps.

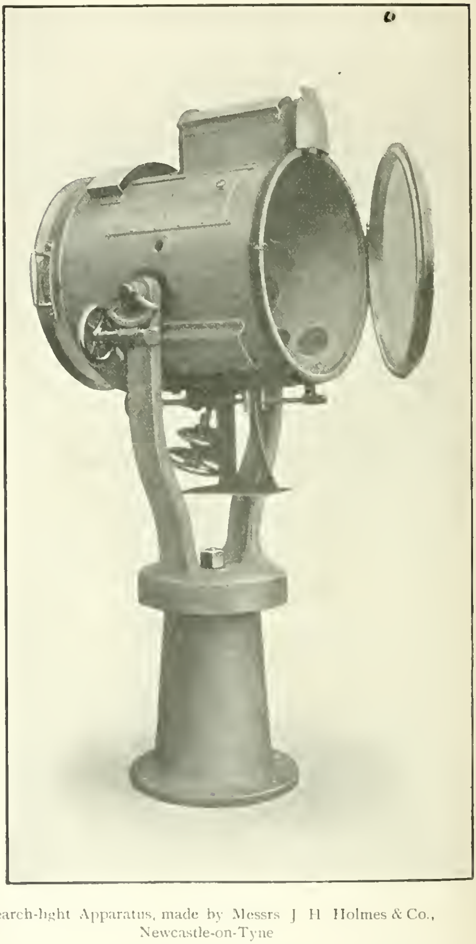
Mechanism is required in all arc lamps to perform two distinct offices, to strike the arc, as it is called, and to feed the carbons towards each other as they burn away. With search-lights both operations are often performed by hand. The attendant switches the current on, and then separates the carbons to the distance necessary to furnish the light he requires, by means of screws provided for the purpose, and he feeds them towards each other by the same means, as they consume. This is perhaps the best arrangement for search-light work, as the attendant has the whole thing completely under his control, and if he knows his work, and is familiar with his apparatus, he can produce much better results than are possible with automatic gear. For cargo lights, and for some forms of search-lights both operations are performed automatically, by electro-magnets contained in the case of the lamp, usually above the arc with cargo lights, and below it with search-lights. Various devices are employed for separating the carbons, striking the arc and for feeding them towards each other, and the endeavour is usually made to combine the two in one. Thus, some form of lifting arrangement will be employed to separate the carbons when the current is switched on, the lifting gear being actuated by an electro-magnet through whose coils the whole of the current for the lamp passes, and the apparatus holding the upper carbon will be released for an instant when a feed is to take place, the release being accomplished by a second electro-magnet, whose pull increases as the length of the arc increases. A favourite arrangement in modern arc lamps is a brake wheel, carrying a chain on its periphery, rotated, in one direction by the main magnet, as it is called, the electro-magnet through whose coils the whole current passes, and in the opposite direction by the shunt magnet, as it is called. One end of the chain is attached to the upper carbon holder, the other end being sometimes taken round a pulley under and then attached to the lower carbon holder, and sometimes merely attached to the brake wheel. As the brake wheel rotates in one direction, the carbons are separated, and as it rotates in the opposite direction, they are allowed to approach. In another form of lamp, clockwork is employed for the feeding mechanism, the whole of the wheel train being moved by the main magnet, when the arc is struck, and the wheel train being released by the shunt magnet, when a feed is to take place. In the shunt lamps referred to above, a spring takes the place of the main magnet, and the ends of the carbons are separated when at rest, by the pull of the spring. The shunt magnet referred to has coils of fine wire, and they are bridged across either the arc, or across the terminals of the lamp, in shunt, or in parallel with the main current. The arrangement is similar to that of the field magnet coils of the shunt-wound machine described in a previous article. When the arc is burning normally, the shunt coils receive very little current, but as the arc increases in length, the current passing in the shunt coils increases, and at a certain length, which can be regulated, the pull of the shunt magnet is sufficient to operate the feed mechanism, to rotate the brake wheel, or to release the clockwork. In the shunt lamps, when the current is first switched on, the shunt coils receive a comparatively powerful current, and they over power the opposing spring and allow the carbons to run together. Immediately the carbons touch, the shunt magnet loses its power, and the spring comes into operation, separating the carbons, and striking the arc, as the main magnet does.

The length of the arc, as it is termed, the distance between the ends of the carbons, varies, in different forms of lamps.

* For Articles I. to XIV., see previous issues.

With what are called "open arc" lamps it is not more than $\frac{3}{32}''$. With "enclosed arc" lamps it may be anywhere from $\frac{3}{8}''$ to $\frac{3}{4}''$, and the writer has seen even 1". With search-lights very long arcs are often employed, usually longer than those in the enclosed arc lamp. In the "enclosed arc," the ends of the carbons are enclosed inside a globe, or glass funnel, partially sealed, and the arc burns largely in an atmosphere of carbonic acid gas, with the result that the waste by oxidation is almost neutralized, and the carbons burn very much longer. Where the open arc lamp requires to be trimmed every twelve or at most twenty-four hours of burning, the enclosed arc will burn from 75 to 150 hours. It is doubtful whether this is any great advantage for cargo lights, though it is found to be a great advantage on shore. The enclosed arc has another advantage, in that it emits the light very much more freely. The very small arc of the open arc lamp confines the light rays very much, while the long arc of the enclosed lamp allows them to emerge. The enclosed arc does not give such a good return in light for current expended, but for cargo work the difference is not serious. An important point, however, is that the carbons employed with enclosed lamps must be very pure. Cheap carbons, such as would sometimes be the only ones procurable in some ports, would be fatal to the steady burning of the lamp. The mechanism of the enclosed arc lamp is very much simpler than that of the open arc lamp. It consists usually of only one electro-magnet, whose office is to separate the carbons, the feed being accomplished by the weakening of the pull of the magnet, the upper carbon then slipping down a short distance. It should be understood that all arc lamps wink, when they feed, and the enclosed lamp has an advantage in this respect, that the feeds take place much less frequently, and though they are more perceptible when they do occur, for outdoor work, this does not much matter, provided there is plenty of light. The one great secret with illumination by means of arc lamps is to have plenty of lamps, so that when one feeds it will not make a serious difference to the general lighting effect. It is wise, therefore, not to depend upon one arc lamp for cargo work, and as will be explained when dealing with the supply of current to cargo lamps, it will be more convenient usually to burn two or more lamps together, and to produce a good general illumination, than to depend upon one lamp only. It is a necessity of the working of the open arc lamp that feeding shall take place somewhat frequently. It is by small, frequent feeds that the lamp is made to burn well. So long as the feeds are small, the winks are also small, but if the lamp is dirty the wink may be large.

There is another form of arc lamp that has been introduced during recent years and that is making steady headway on shore, known as the Flame Arc Lamp. In the Flame Arc, the feature that has been mentioned above, of the arc or bridge of hot gaseous matter, is very much accentuated. The flame is spread out like a fan, below the carbon an electro-magnet specially arranged for the purpose causing this. The arc and its flame obey the laws of electro-magnetism, and when an electro-magnet is placed in a certain position with reference to the arc the latter is pushed outwards, away from the electro-magnet, the result being the fanlike appearance produced in those orange-coloured lights to be seen on shore, in London and some other towns. The flame arc has the great advantage that all its light is cast downwards, and that there are no shadows, such as those cast by the supports of the lower carbon, of the globe in other lamps, etc. In addition, the carbons employed with flame arc lamps are impregnated with the salts of sodium, strontium, calcium, and other metals, and this is the cause of the golden colour of the light. The salts carried in the pores of the carbons are vaporized as well as the carbon. In one case the flame arc lamp burns with a light of a similar colour to the ordinary arc the makers having discarded the salts which give the golden hue. The lamp has another advantage apart from the absence of shadows, which may be of importance in cargo work, the light given for a given expenditure of electricity is many times greater than with the ordinary arc lamp, whether open or enclosed. Some of the salts with which the carbons are impregnated also confer upon the light another property that may be of importance in certain cases. The light given is practically true to sunlight so far as the colours of substances are concerned. This matter is perhaps of more importance in a dye house but it may be of importance when shipping certain kinds of cargo. White light, it will be remembered is made up of the whole of the colours of the rainbow in certain proportions. All forms of artificial light are also made up of lights of different colours, blended together, but the proportions of the different colours are rarely the same as in sunlight. Nearly all forms of light are particularly rich in red light, the exceptions being the mercury vapour lamp that has recently been put on the market, and some forms of flame arc lamps. Where the light is rich in red rays, some of the colours show quite differently from their colours



Search-light Apparatus, made by Messrs J H Holmes & Co., Newcastle-on-Tyne

in sunlight. The deep purples, for instance, show black. On the other hand, with the mercury vapour lamps, which are rich in violet and have hardly any red, the pinks show black. The present writer has tested every form of light that has been introduced, and he has only found the flame arc true, and that only when salts of sodium are used for impregnation. The illustration shews a search-light apparatus made by Messrs. J. H. Holmes & Co., of Newcastle-on-Tyne.

JAMES WATT ANNIVERSARY.

THE anniversary of the birth of James Watt has, as usual, been celebrated by the people of Greenock—the town of Watt's nativity—and by the engineering and shipbuilding community of the Clyde and the West of Scotland, as represented by the Institution of Engineers and Shipbuilders in Scotland. The observance in the case of Greenock took the form of the customary Watt lecture by a man of scientific eminence, and in the case of the Institution of Engineers and Shipbuilders it took the form of the time-honoured Watt dinner, at which men of note in the engineering world were present as guests. Both functions on this occasion took place on the same evening, Friday, the 17th January. The lecturer at Greenock was Mr. Frederick Soddy, lecturer on physical chemistry, Glasgow University, who dealt with "The sources of Radio-active energy." Prior to the lecture, Dr. Robert Caird, who was in the chair, made reference to the death of Lord Kelvin. This great scientist was the Watt lecturer for 1869, his subject being "Elasticity as an Effect of Motion." Five years before that date, Dr. Caird said, Lord Kelvin had induced Mr. Toule to give a lecture on "The Source of Heat," so that through Lord Kelvin's kindly interest the Greenock Philosophical Society had been kept in touch with the evolution of the modern science of thermodynamics, and put in communication with those pioneers who, with him, established it and linked it with the applications of steam to the means of transport and to marine propulsion. In 1875 Lord Kelvin lectured to them on "Navigation," a subject that always lay near to his heart, and his devotion to which led him to the improvements on the mariner's compass and on deep-sea sounding, as well as to the observation, recording and prediction of tidal variations. His researches in wave motion had exerted a direct influence on problems of ship resistance, which, however, on account of their abstruce character appealed to a limited number of students. It might be safely asserted that there was no field of scientific investigation—no application of science to practice—during the nineteenth century in which Lord Kelvin was not a leader, *facile princeps*, among discoverers and inventors. Mention need only be made of ocean telegraphy and the development of electrical science, reaching far down into the root of things, and revolutionizing our conceptions of fundamental natural phenomena, even of the constitution of matter itself. There had been no greater physicist since Newton, by whose side he lay in Westminster Abbey—twin brothers in faith as in science.

Mr. Soddy, in the course of his lecture, said that if we sought the one influence which had contributed more than any other to the mastery over the forces of Nature, and with it mastery over the materials with which Nature provided us, it would be found in the development of steam power, which we owed so largely to the life and work of James Watt. In this he was something more than the inventor of the steam engine, great as that invention was. Through him mankind learned for the first time, by practical example on a large scale, that man could, and must, control Nature. Watt taught us the proper use of the great external sources of energy stored up by nature in coal and fuel. A new natural source of energy had transpired in the last decade by the discovery of radio-activity. The radio-active elements were spontaneously evolving a perennial supply of energy from year to year, which in some cases, as in that of the element radium, was very large, and in the course of a year amounted to over a hundred times as much as was given out in the combustion of a similar weight of coal. Experiments had proved that the radium was undergoing a very slow change of a new kind, in which the element itself suffered natural transmutation into inactive elements, one of which was helium. About a thousandth part of the radium was computed to be changing annually, so that in the complete change no less than 100,000 times as much energy would be given out as from a similar weight of coal. The source of this new energy was to be found in the internal sources of energy in the elements. All attempts to control radio-active processes, and to accelerate them so that the internal stores of energy could be tapped and made use of, had failed From the nature of the problem this could only be achieved when artificial transmutation became a possibility. These two great problems, the unlocking of the internal energy of matter and transmutation, were in reality one, and infinitely the most important consequence of transmutation, if ever it was accomplished, would be the unlocking of the internal stores of energy in matter. We did not now need another James Watt to tell us of the value of an unlimited and inexhaustible supply of energy if it could be obtained. But what we did need was for Greenock to produce a second James Watt who would arise and put his finger on the lever which controlled these gigantic latent potentialities of matter, and loose them, harnessed and under control to continue the civilizing work of humanity.

The Watt anniversary dinner, which was held in the Grosvenor Restaurant, Glasgow, was very largely attended, Mr. John Ward, president of the Institution of Engineers and Shipbuilders, being in the chair. Among others present were Lord Inverclyde, the Marquis of Ailsa, Rear-Admiral Charles R. Arbuthnot, Sir John Ure Primrose, Bart., Colonel Sir John E. Bingham, Bart., Sheffield; Rear-Admiral John E. Bearcroft, R.N., Sir William Arrol, Sir Nathaniel Dunlop, Mr. James Gilchrist, Mr. W. H. Dugdale Sunderland; Mr. Peter Denny, Dumbarton; Mr. James MacKechnie, Barrow, and Mr. Andrew Laing, Wallsend. Lord Inverclyde, in proposing "The Imperial Forces," remarked that the present policy of the Admiralty in giving out orders for war vessels only when these could not be built in the dockyards was not one that met with acceptance in that part of the world. Those shipbuilders who, at great expense, had laid down plant so as to be ready to meet the requirements of the Government had some ground of complaint. One of the assets of the country were private yards, with their modern up-to-date equipment, and he thought they were entitled to expect orders.

Rear-Admiral Arbuthnot, in replying, remarked that it might be suggested to the Admiralty that one of the new battleships that were to be built might be called "James Watt," as one of the battleships existing when he joined the service was called. He thought the Navy was splendidly organized, but he also thought that efficiency had been sacrificed to organization, and that the Navy was not now fitted as it should be to perform its duties in all parts of the world. The organization of its battle squadrons in home waters had been accompanied by a wholesale reduction of the number of small craft in distant parts of the world. The fleets in home waters were, however, capable of dealing with any combination that might be brought against them.

Mr. Ward, in replying to the toast of "The Institution of Engineers and Shipbuilders in Scotland," proposed by Sir John Ure Primrose, said that as an institution they celebrated their jubilee last year. Their growth had been steady and continuous, and at the present time the total roll strength was 1630. The centenary of steam navigation coincided with the opening of their present session, and his presidential address had been chiefly devoted to the progress made in engineering and shipbuilding during that period. Two facts strongly appealed to him in his researches, as they would to every one who made a thoughtful survey of the applied sciences during the last 100 years. The first was the complacency with which people now received the news of any invention or discovery that was likely to effect a revolution in man's ways of doing things, and the second was the unfettered freedom with which the worker in science was permitted to carry on his labours. Their oldest and most distinguished hon. member, the late Lord Kelvin, who joined in 1859, might truthfully be said to have spent his long and honoured life in the service of his fellows. During the year a number of their younger and most promising members had stepped out of the ranks at the imperative summons of death, and this week two similar and very heavy bereavements had come upon them. On the 15th inst. Sir David Richmond, an esteemed and honoured member, was suddenly called to his rest, while that day their much-loved friend and member of council, Mr. David McGee, of Clydebank, had also passed away. In Mr. McGee, those of them who knew him best, loved him most, and their profession and institution were all the poorer for his loss. His representative and outstanding work as a director and manager of the great Clydebank shipyard would remain as a testimony to his great professional skill and fidelity to duty.

ELECTRICAL NOTES.

(From our Own Correspondent.)

Sparking.

THIS is, of course, a question that lies at the root of all electrical design. There are many causes of the evil, some of which are too abstruse for the general reader, but we may note a few points in construction which tend to produce a large amount of sparking, such as bad arrangement of commutator segments and brushes; faulty brush tension and bad alignment of brushes, which should reach each copper segment at the same instant; the material of brushes to be considered, which for high voltage machines should be hard carbon and for low voltage soft, while for fast-running machines copper brushes are better, on account of wear of commutator. A rise of commutator bars due to slackness of ring is sometimes the cause. Mechanical defects in design of machine generally may also account for sparking, but these are likely to be more readily distinguishable and unnecessary to mention.

Dynamo Design.

Among the considerations which govern the type and designs of dynamos we give a few leading features. It is desired by any good machine to produce as much magnetic flux as possible in the armature space, and have the excitation as small as possible by keeping the magnetic circuit small, to do without leakage and obtain as large a capacity as possible per unit of weight. Such considerations as these give bipolar machines for small capacities increasing up to six poles for say 100 k.w. machines and over. It is fairly obvious that increase of the number of poles allows us to run slower for the same E.M.F. The division of magnetic flux enables the weight of iron to be reduced and the diameter of the armature to be increased. The heat is more readily dissipated in this form, also giving a great advantage in temperature. Better proportioning of armature winding follows from this arrangement, and with the less length in air gaps there is a tendency to lessen the sparking.

Coal Handling on Wharves.

This problem is attacked in various ways and electricity plays an important part in the matter. In a system operated by a German firm, in which coal is taken from the vessel and deposited into wagons or on to storage ground; the elevators move along the quay wall and a cable railway is used to distribute the coal over the ground. The elevator is 86 ft. high and carries an arm 40 ft. long which supports a parabola-shaped beam on which a travelling carriage runs with a grab hanging to it. The winding gear is on a platform of the staging, housed in, and when loading, the grab is let down into the hold and opened; when loaded and closed the lift begins vertically until the grab reaches the running carriage on the parabolic arm. Carriage and grab now move up the rail until the latter hangs over the unloading place and emptying begins, the series of operations being then repeated. The winding gear, like the general installation, is of an ingenious character, a good deal of which is automatic in action. The elevators move along the quay wall and each is capable of lifting 50 to 75 tons an hour. By the arrangement it is not possible for any accidental opening of the grab to occur during the lift, which is effected solely by the closing chain. The brake is generally worked by hand but it can be operated electro-magnetically and allows the grab to be lowered by its own weight. Two controllers of 60 and 200 amps. respectively are provided both of which are reversible and have powerful blow out arrangements. As the load varies from no load to that corresponding to 150 H.P. a close regulation is necessary, and for this purpose the lifting controller is double, so that separate and simultaneous working can be obtained. First one half of the controller is switched in, the brake lifting magnet is released and the motor starts. The second drum is then switched in in parallel, it being impossible to short circuit either of the half controllers. The number of men required in this installation is four, a crane driver, a man to look after the loading on the cable way, one for uncoupling and a labourer. We are unable to go into closer detail in fact without drawings this could not very well be done. The installation is supplied to Savona Harbour, Italy, by the Cologne firm of Messrs. Pohlig.

Wireless Communication at Sea.

Wireless telephony is already introduced in the U.S. Navy and is operating, we believe, on the fleet proceeding to the Pacific. It is the De Forest system, and the fleet is controlled from ship to ship by this means it is said. Distances of 15 or even a greater number of miles have been covered.

Naval Electric Fittings.

By a recent Admiralty order relative to balancing and other tests to which electrical fittings and circuits must be subjected to at the conclusion of refits in future, or when new machinery is installed, and fixing responsibility, therefore, the general test is as follows:—The tests will be under two heads: (1) long refits; (2) ordinary refits. In the case of "long refits," the whole of the circuits and fittings are to be tested by the dockyard officers prior to the final inspection by Admiralty officials. In the case of "ordinary refits," only new circuits and fittings are to be tested and this will be done by dockyard officers in conjunction with ships' officers. In every instance, dynamos, motors, fire control fittings, dynamo firing instruments, etc., will be tested and balanced. Final inspection and trials will be performed by Admiralty officers, but in their absence by dockyard officers, reports being forwarded to the Admiralty.

REVIEWS.

Lean's Royal Navy List. January, 1908. London: Witherby and Co.

THE Royal Navy List contains much information of a detailed biographical character which cannot be found elsewhere, at least not in the same convenient and well-arranged form. As time goes on this biographical section is developed and extended till it now covers upwards of 200 of large octavo pages. Attention may also be called to the sections on Naval Bibliography—which is very full—and on current Naval History. This latter chapter in the current issue covers a period of six months, and appears a valuable record of the more important happenings during the half-year. To naval men and those interested in the service Lean's Navy List is an indispensable work of reference.

The Patents and Designs Act, 1907. By James Roberts and H. Fletcher Moulton. London: Butterworth & Co.

THIS book is written with the object of giving assistance to those who seek for information as to the interpretation of the new law which came into force on January 1st, 1908, and to point out the practical effects of the same, and is not intended to be a treatise on Patent Law. The many changes in the law affecting the rights of patentees, and particularly those relating to compulsory working and the prohibition of restrictive conditions in licences, are set forth in language that will be clearly understood by the lay mind, and the authors have made an earnest endeavour to throw light on certain of the new provisions where the language employed in the Act has rendered the meaning far from clear. It must be borne in mind, however, that the real interpretation cannot be definitely settled till some time in the future when the judicature have decided what is the view to be taken. In many instances decisions are referred to in order to assist the reader in coming to a conclusion on the right lines.

The introduction to the subject, which occupies some 35 pages, deals with the general provisions in a very concise and satisfactory manner, and explains the cumbrous procedure adopted by the Government in passing the Amending Act (7 Edw. 7 c. 28), which was only for a moment the law of this law before it was repealed by the Act that is now in force. The public will, in reading this explanation, be assisted very materially in grasping the relative position of the various Acts and the net result of recent legislation so far as it is at present understood.

The general get up of the work is very good and useful reference is made in heavy type to the pages of the "grant and validity of British Patents for Inventions" by James Roberts, which we feel sure will be of great assistance to the reader in appreciating the relationship of the sections to the general interpretation of the law as decided by the law-courts. The authors' notes on the effect of the various sections on the practice under the new law are concise and comprehensive, and indicate in what possible direction enlightenment is to be looked for in the future from legal decisions.

The book will be found most useful to those practising in the patent profession.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

New Shipbuilding Orders.—Messrs. Russell & Co., Port Glasgow, have received from Messrs. Robert Shankland and Co., shipowners, Greenock, an order for a first-class steamer with a deadweight carrying capacity of 8400 tons. The vessel is to be fitted with the best and latest appliances for the rapid loading and discharging of cargo, and will have accommodation for a number of passengers. This is the fifth steamer placed by the firm with Messrs. Russell & Co. in four years. Messrs. Rankin & Blackmore, Greenock, will supply triple-expansion engines of 2700 indicated horse-power, capable of giving on a small consumption of coal, a speed of 10½ knots. Competition for the contract, by East Coast builders especially, is said to have been very keen. An order has been secured by the Clyde Shipbuilding and Engineering Company, Limited, Port Glasgow, to build and engine a steamer of 1000 tons register for London owners, and one of 5,000 tons deadweight for owners in Austria. The Ardrossan Dry Dock and Shipbuilding Company, Ltd., have received an order for two single-screw steamers of special design, with propeller working in tunnel, for Colonial service, and also a high-power steel motor launch for London clients. Messrs. Ferguson Brothers, dredger builders, Port Glasgow, have been commissioned by the Tees Conservancy to build a powerful bucket dredger for service in the river Tees at Middlesbrough. Messrs. Wallace & Co., naval architects, 153, St. Vincent Street, Glasgow, have placed an order with Messrs. Alley & MacLellan, Glasgow, for five 100-ton steel sailing barges on foreign account.

Naval Work.—Scott's Shipbuilding and Engineering Company, Greenock, have received an order from the Admiralty to supply the engines for the battleship ***St. Vincent*** to be constructed in one of the Government dockyards. The machinery will be of the turbine type, with water-tube boilers, and have an aggregate horse-power of 24,500, estimated to give the vessel a speed of 21 knots. The firm will also supply eighteen Babcock & Wilcox water-tube boilers of the most recent type, and equip the warship with about fifty sets of auxiliary engines. The firm, it may be recalled, have already executed important Admiralty contracts, including the machinery for the armoured cruiser *Defence* and the building of the first-class cruiser ***Argyll***. Apart from this order the Clyde, in the matter of naval work, has not benefited from the recent allocation of work to private firms. The order is regarded on Clydeside as merely a crumb from the table of plenty. The last hopes of the West of Scotland of further participating in naval contracts is apparently reduced to a share in the orders for armour-plating for the two battleships to be built in the Royal yards. The plating for all three ships is not yet placed, but high hopes are entertained that a goodly share of the material to be ordered will find its way to the West of Scotland.

King's Turbine Yacht "Alexandra."—Slow progress is being made with the completion of the King's new yacht, which is still lying in the Kelvin, alongside Messrs. A. & J. Inglis, the builders' quay. It appears that the delay is largely, if not entirely, due to the slow progress of some of the sub-contractors, who in turn contend that the Admiralty officials are too hard to please. The ***Alexandra***, according to the original arrangement, should have been ready in June last, but it will be two or three months yet before she is put into commission. It is only natural in the circumstances that the builders should feel annoyed at the delay that has taken place, and for which they are not responsible.

New P. & O. Liners.—At the yard of Messrs. Caird & Co., Greenock, the construction of a new Peninsular and Oriental steamer is being rapidly pushed forward, and the vessel is expected to be ready for launching next month. She is intended for the Aden-Bombay service, and will, it is hoped be ready for the incoming season. Of the two still larger boats (the ***Malwa*** and the ***Mantua***) one is also taking shape in the same yard. These two vessels will be the largest passenger steamers ever built in Greenock, and they will also be the largest in the P. & O. fleet.

New Engineering Works.—Messrs. Drysdale & Co., centrifugal pump engineers, Glasgow, whose works in the east end of the city, although extended from time to time, have for some years past proved inadequate to the demands of their business, have now removed entirely to new works built on a liberal scale in the Yoker district on the north side of the Clyde, about four or five miles west of the city, where already the industrial trend which has been going on for a number of years has located quite a number of engineering establishments. The site of the new works lies between the new shipyard and graving dock of Messrs. Shearer & Sons at Scotstoun, and the Yoker and Renfrew Ferry Road, contiguous to the latter being the works of Bull's Metal and Melloid Co., Ltd., which are comparatively of modern date. Nearer to these than Shearer's dock and shipyard are the extensive works, now practically completed, of Yarrow & Co., who are removing from the Thames, and the important establishment of the Coventry Ordnance Co., jointly owned by Cammell, Laird & Co., Birkenhead, John Brown & Co., Clydebank, and the Fairfield Shipbuilding and Engineering Co., Govan. The site of Drysdale & Co.'s new works, in common with those just referred to, has the advantage of close adjacency to two main lines of railway, the North British and Caledonian, lying in fact between the latter system and the river Clyde. The new works have been built on the latest principles of joint constructional steel and brickwork, the contractors for the steel construction being P. & R. Fleming, Glasgow. The whole of the firm's present plant at Bon-Accord Works, off London Road, has been transferred to the new premises, this including many quite new machines which the firm have not had long in use. Electricity for power purposes as well as for lighting is adopted to a large extent, current being generated by the firm themselves. Steam for the generating plant is supplied from water-tube boilers of the Babcock & Wilcox type. In addition the firm take a considerable proportion of the current they require from the Clyde Valley Electrical Supply Co., whose huge power station is within a quarter of a mile of the new works.

Shipyard Machine Tools.—Messrs. Smith Bros. & Co., machine tool makers, Kinning Park, Glasgow, have completed the first example of a new patent hydraulic section-bar shearing machine, capable of shearing any size of joist up to 16 in. deep, and any size of zed, channel, or bulb-angle bar up to 15 in. deep, angle bars up to 8 in. by 6 in. by 1 in., and standard sizes of T-bars and hatch rests. Shearing can be effected either absolutely square or to any angle up to 18 deg., and the shearing of even the lightest sections is done without any distortion of the material. The same firm have lately shipped to Germany, Austria and Japan a large number of their specialities in shipyard machine tools, and at the present time they have on hand, amongst other notable items, a set of plate rolls for a German shipyard which will rank amongst the largest tools of this description ever produced. The rolls are capable of dealing with plates 36 ft. 6 in. long and 1 ⅝ in. thick. Another of the machine tools of note lately turned out was a heavy plate-edge planing machine, capable of dealing with nickel steel plates up to 30 ft. long and 2 in. thick. This was supplied to Messrs. Vickers, Sons and Maxim, Ltd., Barrow-in-Furness, but similarly capable planing machines have been supplied to users in Japan and other foreign countries.

THE TYNE.

(*From our Own Correspondent.*)

Wages Complications on the North-East Coast.—On the question of a general wages reduction, which in the present state of the shipbuilding industry has become imperative, unexpected complications have arisen. In the case of all the trades, excepting the shipbuilding sections of the Boilermakers' Society and the labourers working in connection with them, who have agreed to the reduction, the employers, in their desire to prevent disruption, decided to modify their original demand, but their amended proposal for a reduction has, although strongly recommended by the men's leaders, on a ballot vote been rejected. The result of this is that at all the North-east Coast yards, the joiners, shipwrights, drillers and some other sections have come out on strike, the extended notices having expired on the 21st inst. The number of men "out" is estimated to be about 4000, but

this number is certain to be largely augmented within the next week or two if a settlement is not effected. It is a generally accepted fact that once the fatal step of coming out on strike has been taken, the difficulty of making a settlement becomes immeasurably greater. As we have frequently pointed out in these columns, the employers never permit a stoppage of work to take place which they can avert by reasonable concessions, but when they are driven to extremities, as they evidently are in the present instance, they are bound to let things take their course. The natural course in a case like the present is that the strikers, after a longer or shorter term of unavailing resistance, must submit to the inevitable, and go back to work (those of them who can get back) sadder, if not wiser, men. The employers are now put on the defensive, and as surely as they have not provoked a quarrel, they will not abandon the position they have taken up. As to the necessity for the reduction no more need be said than this—that fully half the building berths in the wide district affected are empty, and at every port a number of steamers, which is daily becoming larger, are being laid up. In this crisis outside busybodies who know nothing of the questions at issue are talking about arbitration. This talk is certainly premature, to be used on the very first day of the strike, and it is certain that neither party to the dispute will pay the least attention to it. The only way by which the dispute can be brought to an end is the unconditional submission of the men to the very reasonable terms proposed, and this will doubtless take place as soon as they have had time to more carefully consider the matter.

Messrs. Armstrong, Whitworth & Co.—This company continue to hold the leading place on the Tyne in the matter of work in progress, their yards at Elswick and Low Walker being both kept busy. At the first-mentioned establishment there are on the stocks the battleship *Superb* and the armoured cruiser *Invincible*, for the Home Government, and also war vessels for Brazil and Argentine. At the company's Low Walker yard there is a large amount of work in hand, all the vessels on the stocks being of large size. A Japanese vessel having two funnels placed in the after part is being fitted out in the water, and it is understood that some of the vessels on the stocks are also for Japan. The adjoining yard (Messrs. Dobsons') is also well supplied with work, one of the vessels in hand being of exceptionally large size, and nearly ready for delivery.

Messrs. Wood, Skinner & Co. — Towards the end of December this firm launched a beautifully-designed passenger and cargo steamer for the South American coasting trade (between Valparaiso and Panama), which is now having her fittings completed beside the yard. The keel for a vessel of good size has just been laid, and there are two others on the stocks. There are also several barges, or small craft of the barge type, in hand, and the outlook, so far as a continuance of full work in the yard is concerned, is very satisfactory.

Work at the Wallsend Yards.—At Messrs. Swan, Hunter and Wigham Richardson's east yard there are three or four large vessels in hand, one of these being under construction in the covered berth in which the *Mauretania* was built. At the company's west yard three large vessels are in progress and a couple of vessels are in the water being fitted out. At both yards berths are vacant, and advantage is being taken of this circumstance to push on the work of equipping one of the larger berths with overhead gear for hoisting purposes. Messrs. Hawthorne, Leslie & Co. have two large vessels building, and the keel for another has just been laid. There are also some three or four torpedo destroyers on the stocks, and the graving dock is occupied by a good sized boat undergoing repair.

Messrs. Stephenson's Yard, Hebburn.—This establishment still has a fair amount of work on the stocks, the three or four vessels in hand being all of large dimensions. There is also a considerable amount of repair work to be dealt with. The Palmer Company have, so far as can be seen, only a limited amount of work in progress, a considerable portion of this being on Admiralty account. The battleship *Lord Nelson* is completed, and is now being got in readiness for the course of exhaustive trials that are deemed essential. The Northumberland Shipbuilding Company have just launched a large vessel and have four in early stages of progress. Messrs. Readhead have commenced preparations for the building of a vessel and it is stated that a second berth may shortly be occupied.

New Graving Dock.—The Mercantile Dry Dock Company, Jarrow, have commenced the construction of a third graving dock at the west side of their premises. It is to be 440 ft. long by 60 ft. in width, and will be equipped with all the latest accessories for facilitating work. The dock gates will be constructed by Messrs. Eltringham & Co., South Shields, and will be operated by an electric windlass of special design, to be supplied by Messrs. Clark, Chapman & Co., Gateshead. The workshops connected with these dry docks are now fitted throughout with electrical machinery.

The State of the Engineering Work.—At Messrs. Hawthorn, Leslie & Co., St. Peter's Engine Works, the state of work is exceptionally good, and a full night shift is, we understand, kept on. There are several turbine engines in hand for vessels building on Admiralty account, and there are also in progress some sets of engines of the ordinary marine type. The Wallsend Works of the North-Eastern Marine Engineering Company are still kept satisfactorily going, and at the Wallsend Slipway Works there appears to be a fair amount of work in hand. As regards the manufacture of steamship auxiliary machinery, Messrs. Donkin & Co., Walker Gate, are understood to be well supplied with orders in this line. Messrs. Parsons' Works, Walker Gate, are well employed in the manufacture of colliery requisites in electrical machinery, and the firm's Wallsend establishment is also busy.

THE WEAR.

(From our Own Correspondent.)

State of Shipbuilding.—We are pleased to note that Messrs. J. L. Thompson & Sons have resumed frame-turning after a prolonged stoppage in this department. This firm are foremost in the possession of facilities for quick and economical production, and it would be quite a new experience if the existing depression in shipbuilding were to affect them as deeply as it is seen to be affecting others. Messrs. John Crown & Sons, who some months ago increased the number of their building berths to three, have just placed the keel for a vessel, and frame-turning is to be commenced very shortly. The Sunderland Shipbuilding Company are steadily proceeding with the work in hand and are adding daily to the number of hands employed. Notwithstanding these few signs of a possible coming improvement, shipbuilding at this centre is still almost at the extremity of slackness, and anyone who may harbour optimistic views on the assumption that the advent of spring usually causes more stir in trade, will, in all probability, find themselves mistaken. Messrs. Austin continue to be busy in repair work, both their graving docks and pontoon being occupied. On the upper reaches of the river there is no change to note, the most interesting feature being the circumstance that Messrs. Osborne, Graham & Co. are still keeping busy. It should be noted that the Wear shipbuilding firms are not affected by the present strike, the wages differences having been adjusted through the medium of the Conciliation Board.

Engineering Work.—The announcemnt has appeared that Messrs. Clark, of the Southwick Engine Works, had recently been the recipients of orders for a number of marine engine sets, and there is consequently a prospect of improved business at this establishment. The Palmer's Hill Works are still slack, but there is little reason to doubt that whenever a revival takes place these works will be among the first to participate.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

Ship Canal Traffic.—Taking a retrospective view of the Ship Canal traffic during the year 1907, the result must be considered altogether satisfactory. Up to the end of November the increase had totalled £28,000 odd. December has always been a good month, and the known traffic during that month will, when the results are known, prove that the shareholders have better hopes than ever of some day getting a dividend on the money they invested so freely when the

Canal was constructed. Every year has shown an advance upon the year preceding. The total is expected to turn out at about £530,000. There has been a steady and gratifying increase in our imports and exports. With regard to the former, Manchester occupies a rather remarkable and unexpected position among the first ports of the kingdom, and is practically on a par with Glasgow. Exports however, have not shown the same increase. If the increase on that side had been equal with the other, the shareholders might by now have been receiving something. The Canal, however, has benefited Manchester, Salford and the whole of this part of the country in no small degree. The people have benefited by cheaper foods, especially in meats and fruits. A great stimulus has been given to the establishment of manufactories of various kinds on the banks and on lands in close proximity to the waterway. Trafford Park, for instance—once the ancestral home of the De Traffords—is now a vast commercial centre, employing tens of thousands of workpeople. With regard to cotton, however, it seems strange that the imports of American cotton have fallen off, while those of Egyptian have increased. There must be potent influences at work to keep back a commodity which might fairly be said to nourish the life-blood of the Lancashire cotton operatives. At present we have no direct steamship communication with East and South Africa, but it is not unlikely that in the not distant future the newly-established Manchester Association of Importers and Exporters will have a far-reaching influence in this direction.

The Manchester Dry Docks Co. held its annual meeting at Newcastle. The figures were very similar to those published last year. £16,784 had been added to capital account. The £8,000 loan had been taken over in preference shares. The capital of the Company is £136,315. The position of the Company is thoroughly sound. The new dock has proved a thorough success. The extension of the old dock had also been very satisfactory. All three docks had been unable to cope with the business. Some orders have had to be executed elsewhere. £2,500 had been added to the depreciation fund and £200 to the reserve fund. A dividend of 7½ per cent. has been paid.

The Manchester Corporation.—The Finance Committee have presented a bill to the Ship Canal Co. for £80,000 for a half-year's interest, due January 1st, on Corporation debentures —£5,000,000 at 3½ per cent. To this, £80,000 is added £13,975 for arrears of interest, which brings up the total to £93,978.

Timber.—The imports of timber to the Manchester docks during 1907 were as follows: Heron pitchpine, 62,000 cubic feet; sawn ditto, 1,724,000; pitchpine planks, 231,000; Quebec board pine, 661,000; birch logs, 48,000; oak (Canadian and U.S.A.), 39,000. Spruce deals (standards), 61,450; pine deals, 5,660; Baltic deals, 29,280; Baltic flooring, 13,940; Galatz, etc., whitewood, 3,160. As compared with 1906, the imports show a net decrease of about 15,500 standards, but consumption has been well maintained, and in pitchpine has greatly increased.

The Lancashire Iron Trade during the month has been continually declining. This applies to all brands of pig iron, hæmatites, manufactured iron and steel. A number of smelting furnaces have been cooled down; stocks are depleted; and prospects not favourable for new business. Prices of Scotch metals have maintained the highest averages, which is practically accounted for by their quality and smaller quantity. Copper and tin have also descended by leaps and bounds to more reasonable figures, where for the last fortnight they have been almost stationary, varying very little. The sudden series of falls proved a loss to many. In 1896 and 1897 the mean price of tin was under £60 per ton. In fact for thirty-seven years the average mean price was £98 10s. per ton, but since 1899 the average was £140 3s. 9d. The highest figures were reached in 1906. For a short time the price was £215 per ton. At the Manchester Iron Exchange on the 22nd January bar iron was uniformly reduced 10s. per ton.

The Coal Trade of the Manchester and other mining districts of Lancashire continues on an unprecedented scale of prosperity for colliery proprietors and coal merchants. Prices were never so high, and the demand never so generally good. The cause, of course, is due to the unexampled volume of trade which has been enjoyed by the country during 1907. In Lancashire the cotton trade has swollen to dimensions hitherto unknown. New mills, both for spinning and weaving, have sprung up with mushroom rapidity and are still being built. The profits for the last year or two have been remarkable. Scarcely any of the limited liability companies have paid dividends of less than 10 per cent. and some have reached 12, 15, 20, and in exceptional cases, 30 per cent. It is due to these mills and to the prosperity of the textile and other engineering works that the demand for steam coal has been so great, and practically more than the colliery companies have been able fully to supply. The shipping industry in the use and exportation of coal has proved a considerable factor in keeping up the demand. There has been a slight increase in prices in the Wigan district, about 6d. per ton, and it was expected that the Manchester district would follow but at the date of this letter no general advance had been made. Prices are still on the scale settled in September last.

THAMES.

(From our Own Correspondent.)

Forthcoming Port Legislation.—As the time draws near for the meeting of Parliament with its promised bill, those interested are on tip-toe to know what is in store for them. The Docks, primarily, followed by other parties, such as the Thames Conservancy, the Trinity House, the Waterman's Co., the Sanitary Authority and even the police, all these and more stand to win or lose by any changes which will be effected. It is not a small question, as the port practically comprises a length of fifty miles, in which there are harbour masters who regulate and control the traffic, assign vessels' movements and take charge of loading and unloading. Then there are wrecks to be attended to, dredging, docks piers and embankments, with the various moorings and beacons all to be supervised. The carrying out of the Explosives and Petroleum Acts is another matter. Dockmasters and watermen have all to receive certificates before acting. Sanitary protection has to be provided for and then there is the police supervision. Though with different bodies doing the work, everything seems to fit in, if we may so express the matter. There is a great work carried on, with no friction between the various controlling powers. As we know, the proposal is to have one authority to do the work that so many do now, it must be admitted, with fair effectiveness. That we are dealing with a vast concern is evident from the fact that the trade of the port in imports and revenue is equal in each case to about one-third of the total of the United Kingdom, and the value of the Docks is given at over thirty millions and the income at one-and-a-quarter millions. With the various interests, deputations have paid visits to the president of the Board of Trade, who is understood to have replied that he proposed under the new arrangements to have open competition, where, as it is implied there is now an absence of freedom, as in the case of the watermen, in which the Waterman's Co. grant licences to duly qualified men.

Thames Conservancy.—At the meeting of this Board recently, Lord Desborough was elected chairman for the fourth year. In the course of the speech from the chair it was remarked as to the dredging operations in progress and the saving that has been effected by having one large dredger instead of two smaller ones authorised, this saving being about £20,000, besides that in working expenses. The tonnage entering the port in 1907 was about the same as in 1906, *viz.*, 26,960,000 tons 154 vessels over 5,000 tons entered the port as against 36 in 1900.

Dock Reports.—The London and India Docks Co. has declared a dividend of 3 per cent. for the year 1907. This is against 2½ per cent. last year. The amount required to pay the dividend is, after payment of preferred stocks, a sum of £147,514, the amount carried forward being £3,607, slightly in advance of last year.

Commonwealth Mail Contract.—The text of the agreement between the Orient Co. and the Australian Postmaster-General has now reached this country. The service is to be a fortnightly one, for which the subsidy is £170,000, and comes into operation in January, 1910. The contract contemplates Brindisi being used as the mail port. Provisions are made for purchase of the line at any time by the Government and

rates of freight are to be the same to all parts in the Commonwealth from the United Kingdom.

Sanitary Inspection of the Thames.—We have elsewhere referred to the authority in charge of this department who recently made a report as to the conditions ruling under them. One medical officer has five assistants in his charge, and ten inspectors, who are occupied in surveying vessels for any possible infection. The report shows everything to be perfectly satisfactory, even the dredging from the bottom of the river being quite pure.

London Marine Board.—Every three years the list of those persons entitled to vote at the election for members of the Board comes up before the revising justices. The Collector of Customs and the Registrar-General of Shipping and Seamen prepares this list and there were no objections on the recent occasion. The owners of vessels registered as home-going or foreign passengers at the port are on the list, and they have the power of electing six members on the Board, in conjunction with one appointed by the Board of Trade and the mayor and magistrate at each port.

Shipwrights Co.—The late Sir W. G. Pearce, Bart., second warden of this Company, left to the Corporation £500 free of duty, and the Skinners Co. has given a scholarship of £50 a year for three years to the Company for its naval construction classes, carried on under an educational trust, of which Sir W. White is chairman and Lord Pirrie and Sir P. Watts members.

"Warspite" Training Ship.—The quarterly meeting of the Marine Society has been held recently under the presidency of the Earl of Romney. 283 boys were on the vessel and 198 remained at the end of the quarter, while 50 are on the sea-going training ship *Port Jackson* in Australia, subscriptions for which are asked for, there being a deficit.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—Much better prospects are afforded in the shipbuilding trade of this district, and it is certain now that builders will be much busier during the ensuing two years than they have been for some time past. One of the reasons for this improved outlook is the fact that the order for the British battleship *Rodney* has been definitely placed with Vickers, Sons & Maxim, and the time specified for her construction and delivery to the Admiralty is two years. The builders can readily accomplish this task, as they have very great facilities at their disposal. They have a most up-to-date shipyard, and they have not much tonnage on the stocks. Further than this, the quiet times experienced in the past have put a considerable number of men out of work, and they are all ready to resume operations at any moment. The builders are concentrating every effort to get the work of this vessel in hand at the earliest possible date, and before very long they will be able to lay the keel. The firm of Vickers have also secured the order for a Canadian barge crane which, though only a small contract, nevertheless represents a deal of work, and it will help to fill in with other work now proceeding in the yard. Mr. James Dunn, one of Vickers' directors, holds forth the prospect of still further orders coming to Barrow at an early date. At a dinner given to Vickers, Sons & Maxim's directors, officials and foremen at Furness Abbey Hotel by Captain Stetzenko and the ward-room officers of the Russian cruiser *Rurik* just before she left Barrow for the Clyde, he said the order for the *Rodney* was welcomed but he had reason to believe still more important orders were coming to Barrow soon. It is generally known what Mr. Dunn was referring to, but it is as well to wait until the negotiations now in progress have come to fruition before any definite announcement is made of the prospective new business. In the meantime the firm have plenty of work on hand to keep employed the greater majority of their men, and when the vessels in hand are further advanced they will be all the more ready to undertake newer work, which at the moment is more or less in the air. It is a good sign when the draughtsmen's departments are so busy as to render overtime necessary, as well as adding additional hands every week. It is very gratifying to find that when the shipbuilding trade throughout the country is so quiet that the chances of Barrow being very busy are so well assured. But there are compensations in almost every walk of life. During the recent brisk trade in shipbuilding Barrow participated in it only to a very small extent, because the orders given out were not mainly of the class built at Barrow, and possibly because some foreign work was in hand at Barrow which made it necessary for the Admiralty to place certain orders elsewhere, which possibly would have come to the North Lancashire port.

The Russian Cruiser "Rurik."—This fine ship has now been completed, and has left Barrow for the Clyde, where she will undergo her usual acceptance trials. As a finished ship the *Rurik* looked a splendid specimen of naval architecture, and as she possesses many new innovations, and many new improvements which are likely to be adopted on other large fighting ships, she possesses no little interest to those who are identified in any way with modern naval developments. Captain Stetzenko paid a very special compliment to the Barrow firm, not only for the great facilities they have for turning out the best of work, but for the capacity they have of adding to the strength of the navies of the world at their several establishments at Barrow, Sheffield and elsewhere. The *Rurik* has already gone through very exhaustive trials, and was found to steam 21½ knots per hour, or half a knot above her contract speed, and she steered exceedingly well, as a ship of her model is bound to do. The builders have incorporated all their great experience as naval architects so far as was possible within the limits laid down by the Russian authorities. When the trials are over on the Clyde the *Rurik* will proceed to Libau in the Baltic.

A Mexican Transport Ship.—There was launched at Barrow on January 23rd from the Barrow yard a new transport steamer for the Mexican Government. This vessel possesses some interest, because she marks the beginning of a new navy for the Mexican Republic. The particulars of the vessel will be found in another column, but it may be here stated that she is a very complete, if necessarily small, craft, and that the Mexican inspectors who have had charge of her construction have shown a knowledge of shipbuilding which proves they have studied naval architecture, and know how to secure the best results from any vessel they may require in that country.

The Brazilian "Dreadnoughts."—Many rumours have been afloat of late that the two Brazilian *Dreadnoughts* building at Barrow and Newcastle will, in the end, fall into the hands of some other Power. But nothing is known of this, as it is believed Brazil is in a position to pay for the ships as they are being built and when they are finished, and there certainly does not seem to be any reason why they should have essayed to build vessels of this large type if they did not want them. Besides, their action in this matter is likely to be followed by other South American Powers who are preparing to protect themselves, and if they ultimately take this course the policy of Brazil will be to stick to their ships, and be ready for an emergency which perhaps they themselves may have been the means of creating. At any rate, in the meantime the work of construction is proceeding, although not at a very quick rate. Indeed, it is thought possible that the British battleship *Rodney* will be launched before the Brazilian battleship building at Barrow, and in one sense that will be a very great convenience to the Barrow firm.

Early Launches.—The next launch at Barrow will be that of the London and North Western steamer for the Holyhead and Dublin service. This will be the third vessel built at Barrow within the past year for these owners. The two already launched, the *Slieve Bloom* and the *Slieve Gallion*, are cargo boats, designed also for cattle carrying, but the third is a passenger steamer, and will be used to augment the already large fleet of the company's steamers plying between England and Ireland. The second vessel to be launched in the early future will be the new Isle of Man Steampacket Co.'s steamer to sail between Liverpool and Douglas. This vessel, which will be propelled by turbines, is to steam at 25 knots per hour. It is admittedly a difficult task to build a vessel to beat the *Viking* now on the service, and especially so as the new ship is much broader in the beam, and has to carry 2000 passengers. However, the engines are in the hands of competent engineers who have never yet made a mistake in the designed power to be exerted by the engines, and success may therefore be expected, even if in

achieving it another record is established in cross-Channel navigation.

West Cumberland.—The shipbuilding operations at Workington and Maryport go steadily along in brisk times and in times of depression, and this sort of thing is looked upon as a chronic condition. The craft now and at all times engaging their attention is very small in size, but it furnishes a steady run of work, and the builders are content to go on in the good

by a company numbering about 100.

The toast of "The Association" was proposed by the Chairman, who said that the past year had been a very prosperous one, and that the success of the association in the future was assured so long as it had such men as its past chairman, Mr. Hughes, and such efficient members as were numbered among the officials present. They had had many interesting discussions at the monthly meetings, and several

(From our Own Correspondent.)

AS indicative of the progressive strides which Southampton is making as a seaport, it is interesting to note that compared with the year 1906 there was an increase of 160 vessels using the port during the year 1907, the increase in tonnage being over 500,000 tons, whilst for the same period 31,000 more passengers passed through the port.

The White Star Liner "Suevic."—This vessel, of which we give on page 281 four further views to those given in our November issue, one showing the *Suevic* as completed, came out of the Trafalgar Dry Dock on the afternoon of the 8th January last, thus bringing to a successful termination one of the most remarkable feats of marine engineering. It will be remembered that the vessel ran ashore at the Lizard in March last and the after part was salved and towed round to Southampton. A new bow portion was constructed by Messrs. Harland & Wolff at Belfast, and brought round here to be joined to the salved after portion. The after portion was dry docked on the 10th September last, and the new bow portion followed about two months later, the date being November 4th. The operation of joining the two portions occupied just over two months. On leaving the dry dock, the vessel proceeded to a coaling berth and sailed for Liverpool on the 10th January, leaving that port on the 18th January on her voyage to Australia *via* the Cape. Prior to the vessel's departure, Lord Pirrie paid a visit of inspection, accompanied by Mr. Crichton, Messrs. Harland & Wolff's local manager.

Messrs Harland & Wolff are to be congratulated on the successful termination to a masterly and expeditious piece of work and it is also very satisfactory to know that the successful result was contributed to largely by a local firm. We refer to Messrs. J. I. Thornycroft & Co., of Woolston Works, who executed the necessary work in connection with the preparation of the old stern to receive the new bow portion, and subsequently assisted in the work of joining up the two portions of the vessel.

The Royal Mail Steam Packet Company have just added the twin-screw mail steamer *Asturias* to their already large fleet. The vessel is the fifth and largest of the A class of mail ships, which are now so well known and which have been added during the last two years. The *Asturias* is 535 ft. long, with a beam of 62 ft. 4 ins. and a gross register tonnage of 12,200 tons. She has been built and engined by Messrs. Harland & Wolff, of Belfast, and is schooner rigged, with two masts and a single elliptical funnel. Passenger accommodation on a most luxurious scale is her speciality. The staterooms are on deck and there are some very handsome two-bedded state-rooms (no upper berths) with bath-rooms attached. Single-berth state-rooms are a special feature, so that privacy and comfort are secured equal to that afforded by the best hotels ashore. There are several suites-de-luxe, magnificently furnished in white and gold with silk panellings. These suites-de-luxe are a special feature for which the R.M.S.P. Co. are particularly noted. The *Asturias* arrived at Tilbury early on Friday evening, the 10th January last and sailed on her maiden voyage to Australia on the 24th. On her return she will be removed from the Australian route to take her place on the South American Mail Service of the Company, for which she has been specially designed. It is safe to say that the *Asturias* is one of the largest and certainly the most sumptuously fitted vessel which has visited the port of London, and is a splendid tribute to the progressive policy of the Royal Mail Steam Packet Co., of which Mr. Owen C. Philipps, M.P., is chairman.

Day Summers & Co., Ltd., Northam Iron Works.—The large 800-ton steam yacht which is building at this yard is very nearly plated; unfortunately the riveting of the hull was stopped on the 8th January, owing to the local riveters refusing to work to the printed price list. The men's executive committee, however, instructed them to start work, which they did on Friday, January 17th. The concrete block lifting barge, designed and built by the firm for Portsmouth Dockyard and handed over some months ago for work on the new submarine breakwater, has proved a most useful and efficient vessel and has given great satisfaction to the Admiralty authorities. The S.Y. *Maund*, Mr. Mortimer Singer, has had a considerable amount of work done to her and is now lying at the yard awaiting orders. The suction dredger *Precursor* is also laid up at the yard, her annual overhaul and survey being completed. There is a very big machinery job now in hand on the Spanish steamer *Valmaseda*, 2,400 tons. The firm are fitting this vessel with a new condenser, the whole of the machinery has been removed from the ship and is now in course of re-erection in the shop. The hauling up slipway machinery and cradle constructed to the order of the Crown Agents for the Colonies for Calabar is now being dismantled and packed for shipment. The firm have recently carried out a quick and satisfactory repair job of an urgent nature on the Hamburg-American liner *Silvia*. This vessel arrived in the port at 8 p.m. on January 13th with a burst main steam pipe, the pipe was removed from the ship that night, the damaged part cut out and renewed, the pipe retested, refitted and the vessel under steam again by 10 a.m. on the 14th inst. The firm have also in hand two tug boats similar to the two they sent out to South America last summer, which vessels have been very successful and the direct cause of this new order.

BELFAST.

(From our Own Correspondent.)

Work in Progress.—According to Lloyd's Returns for the quarter ending 31st December, the tonnage under construction in Belfast amounted to 194,507. The total for the corresponding period of the previous year was 174,770 tons.

Messrs. Harland & Wolff.—During the month of January this firm completed the fitting out of two notable vessels, namely, the Royal Mail Steam Packet Company's T.S.S. *Asturias* and the big ocean-going barge *Navahoe*, built for the Anglo-American Oil Company. The former is the largest of a whole fleet of magnificent mail steamers recently added to this progressive line. She is a vessel of close on 12,500 tons gross, and accommodation has been provided for about 300 first-class, 140 second-class, and 1,200 third-class passengers. The propelling machinery consists of two sets of quadruple-expansion engines of the builders' usual "balanced" type. The barge *Navahoe* has been constructed for carrying 10,000 tons of oil in bulk, and, as stated in a previous issue, she will be towed by the Company's tanker, *Iroquois*, built by the Queen's Island firm. After completion, the *Navahoe* was taken round to the Musgrave Channel, where she lies awaiting the arrival of the *Iroquois* by which

vessel she will be towed from Belfast. On the 23rd of January, Messrs. Harland & Wolff launched a steamer of about 6,500 gross tonnage named *Memphian* for the Leyland line. The *Memphian* is a sister-ship of the *Median*, put in the water in December for the same owners. In addition to the foregoing Messrs. Harland & Wolff have completed, at Southampton, the repairs to the White Star liner *Suevic*, the operations in connection with the joining up of the new bow portion having been carried out in a little over two months. The leviathan Hamburg American liner is expected to be launched in February.

Messrs. Workman, Clark & Co.—Up to the time of writing, this firm has not put any new tonnage in the water since the first of the year. There are, however, several vessels approaching the launching stage and at the fitting-out wharves there is considerable activity. It is rumoured that they have a very good chance of securing the order for two or three of the new steamers about to be ordered for the Orient line.

Harbour Items.—Reference was made in last month's notes to the completion of the repairs to the Alexandra Graving Dock. Since then the *Asturias* and the *Navahoe*, already mentioned, have been docked in it. In all probability the contract for the construction of the Queen's Road electric tramway will be secured by Messrs. Dick, Kerr & Co. Ltd., the Harbour Commissioners having put this firm's tender before the City Corporation and recommended the acceptance of the same.

Londonderry.—At the last meeting of the Port and Harbour Commissioners it was unanimously resolved that the Government should be requested to give a free grant of £70,000 towards the construction of a graving dock at the port which would take in torpedo and small gun boats, the Admiralty to have the preferential use of the dock at all times. It was pointed out that although they already possess a dock it is quite inadequate for present day purposes, the depth of water on the sill being only 17·0 feet at highest

HEAT NON-CONDUCTING MATERIAL.

FUEL economy is a subject of universal interest, and the present is an age of the keenest competition in all branches of manufacture, with the result that all producers should carefully study their losses by radiation. Messrs. Matthew Keenan & Co., Ltd. have made a study, for the past fifty years, of all heat insulating materials, enabling them to keep up with the present age of high pressures.

On several of the ships the boilers of which this firm have covered with their patent composition, tests have been made by the Superintendent Engineers, and it has been found that with a pressure of 215 lbs., the covering was only ten degrees higher than the surrounding atmosphere, resulting not only in a great saving of fuel, but enabling the stokers to work in comfort.

the method of applying the material in three coats, with wire-netting under the finishing coat.

There are three great advantages in not having the sheet iron on the composition; firstly, it enables the engineers in charge to detect the location of any leaks that take place, and to repair them at end of voyage, thus saving any further damage; secondly, the

...possibly would have come to the North Lancashire port.

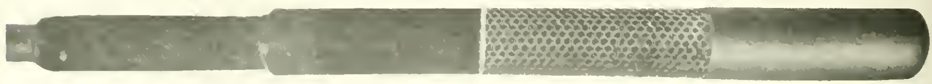
The Russian Cruiser "Rurik."—This fine ship has now been completed and has left Barrow for the Clyde, where she will undergo her usual acceptance trials. As a finished ship the *Rurik* looked a splendid specimen of naval architecture, and as she possesses many new innovations, and many new improvements which are likely to be adopted on other large fighting ships she possesses no little interest to those who are identified in any way with modern naval developments. Captain Stetzenko paid a very special compliment to the Barrow firm, not only for the great facilities they have for turning out the best of work, but for the capacity they have of adding to the strength of the navies of the world at their several establishments at Barrow, Sheffield and elsewhere. The *Rurik* has already gone through very exhaustive trials, and was found to steam 21½ knots per hour, or half a knot above her contract speed, and she steered exceedingly well, as a ship of her model is bound to do. The builders have incorporated all their great experience as naval architects so far as was possible within the limits laid down by the Russian authorities. When the trials are over on the Clyde the *Rurik* will proceed to Libau in the Baltic.

A Mexican Transport Ship.—There was launched at Barrow on January 23rd from the Barrow yard a new transport steamer for the Mexican Government. This vessel possesses some interest, because she marks the beginning of a

stoke-hole is kept at a very much lower temperature; thirdly, a saving in weight of 2·5 lbs. per square foot is made, assuming galvanised iron of 16 gauge to be used.

First-class material and workmanship has always been this firm's motto, and the fact that they are on the Admiralty List, and are also contractors to the War Office, the India Office, H.M. Office of Works, Postmaster-General, London County Council, Metropolitan Asylums Board, Metropolitan Water Board, the principal engineers, shipping and railway companies, etc., etc., is proof of the success that has attended their efforts; and it must be very gratifying to this firm to find, after opening new works in Glasgow some fifteen months ago, that they have had to extend them considerably so as to be in a position to cope with the large number of contracts they have on their books for 1908.

Mr. Horsnell, who is a Member of the Marine and Mechanical Institutes, is Managing Director for th



To get the best result in economy, and at the same time [illegible] a composition to stand for [illegible] years, and still being [illegible] as a non-conductor, has always been [illegible]. A great feature of their composition is that it does not require sheet iron covering over it, as it dries to a hard surface, a small mesh wire being placed over the [illegible] under the finishing coat according to the requirement of the Superintendent Engineer. Should a leak take place at seam or boiler, the composition will show it at once, the wire can then be [illegible] turned back, insulation taken out, and after [illegible] the material can be damped and put on again, and the wire is placed back after insulation has [illegible]. The adjoining illustration shows

ation Company, and having the firm's fifty years experience behind him, will at all times be pleased to place their services at the disposal of engineers.

The firm have lately had the pleasure of carrying out the whole of the covering for the two ships for the Royal Egyptian Mail Co., built by Messrs. Fairfield and Co., also for six Pacific Steam Navigation boats, built by Messrs. Beardmores, and John Brown & Co.; five ships for Fratelli, Consulich, Trieste, built by Messrs. Russell's and Alex. Stephens; four ships for P. & O. Co., two ships for Lloyd Sabaudo Società Genova, Blue Anchor Line.

The [illegible] of the Royal Egyptian Mail Co. (one of the [illegible] above) is illustrated in the adjoining view

FOREMAN BOILERMAKERS' ASSOCIATION.

The sixteenth annual dinner of this association was held in the London Tavern on January 11th, 1908. Mr. J. T. Hicks, the president whose portrait we have the pleasure of giving, occupied the chair and was supported by a company numbering about 100.

The toast of "The Association" was proposed by the Chairman, who said that the past year had been a very prosperous one, and that the success of the association in the future was assured so long as it had such men as its past chairman, Mr. Hughes and such efficient members as were numbered among the officials present. They had had many interesting discussions at the monthly meetings, and several

Photo by Messrs. Barclay Bros., London.

Mr. J. T. Hicks, the President of the Foreman Boilermakers' Association.

instructive papers on electrical welding, and welding by acetylene gas, and oxygen, etc. They had also visited the works of the British Oxygen Company at Westminster; the work they saw there showed them what chemistry was going to do in the future, and convinced them of the necessity of giving their sons the best education possible to enable them to keep abreast of the times. With regard to their financial position, they were at present in a very prosperous condition, owing to the efforts of their secretary, Mr. Gibson and their treasurer, Mr. Williamson.

Mr. Gibson said it was very gratifying to see the heartiness with which the toast of the evening had been received. He agreed with the President that the older men should hand down to the younger men a better education, in order that they might reach a state of higher efficiency.

An interesting ceremony then took place, when the President, according to the annual custom, made a graceful acknowledgement of the services rendered by his predecessor by the presentation of a beautiful silver inkstand and pen.

The recipient, Mr. Hughes, in returning thanks, spoke of the pleasant relations between the office-bearers during 1907, and hoped for equally pleasant ones for his successor.

The toast of "The Ladies" was proposed in a graceful speech by Mr. John Ferguson, and replied to by Mr. George Williamson.

Mr. John Weir, in replying to the next toast of "The Visitors," proposed by Mr. Munro, who heartily welcomed all their friends present said that the hospitable treatment they had received that night from everyone made them feel quite at home, and in returning thanks on behalf of himself and all the other visitors, he desired to convey their hearty congratulations to the Association and their wishes for its future prosperity.

Mr. Coates, the vice-chairman, then proposed the toast of "The Chairman," after the acknowledgment of which the company parted with the singing of "Auld Lang Syne."

OBITUARIES.

John Macfarlane Gray.—The death of Mr. John Macfarlane Gray, which occurred at Edinburgh on January 14th, has removed from the engineering world one whose name is widely known and whose personality only a little less so, and the regrets at his loss to the community are many and deep. Those who enjoyed his friendship have pleasant reminiscences as memorials to soften the shock of his death, while all who came into contact with him have memories of words and questions given to them to ponder over and work out for themselves. Born on the borders of the smallest county in Scotland, at Kincardine-on-Forth, he received but the rudimentary education afforded at a Scottish village school and was set to uncongenial work, from which, however, means were forthcoming to admit of his removal, and in preparation for this he was gathering mental power by the exercise of his faculties in the study of ancient classics, further developing his mind by close application to mathematics and kindred sciences. His knowledge of the Bible was extensive, and it was evident he had made a close study of it and sought inspiration from its pages, some of his papers and lectures evidencing their origin from this source as starting texts. Gaining his experience in the practical work of an engineer on the banks of the Forth, the Clyde and the Mersey, he came forth into prominent notice as the designer of the successful steam-steering gear applied to the *Great Eastern*. Subsequently entering the service as a Board of Trade surveyor, when it became necessary to appoint a Chief Examiner of Engineers qualifying for certificates in the Mercantile Marine he was appointed to the honourable position. Not satisfied with present attainments and results, he ever pressed on towards the higher regions of mathematical and philosophical research, seeking at the same time to lead on those who came into touch with him to study how to think and weigh for themselves the problems of life, whether scientific or ethical. The characteristic power he possessed in great proportion was that of concentrated thinking, seeking to get at the base of things, the why and the wherefore of phenomena and we are indebted to him for the results of many investigations which have a bearing on practical engineering questions and the economics of steam. A member of several societies, both engineering and social, John Macfarlane Gray contributed much to all. From his ultra scientific researches and papers on Thermo-Dynamics—for which he was awarded the Telford medal by the Institution of Civil Engineers—as well as lectures and papers given to young men with the object of helping them to habits of thinking and stimulating them to investigate things for themselves, were each and all appreciated and welcomed. One of such lectures was entitled "Nothing or the non-existent;" in it he dealt with vacuum, so-called, how obtained and made use of experimentally and commercially; what remained in the bulb after the air was exhausted. Such a question had puzzled men of science since the days of Job, who had the question before him in another form: "Where is the way where light dwelleth?" The various theories o

all ages were reviewed and explained. The mind of man, its capacity, its capability of exercise and training; the external world and the various phenomena connected with it were touched upon; he concluded with a peroration, which yet awakes responsive chords, when he referred to the parable of the talents and commented upon the idiot who started with nothing in the shape of talents and gave nothing; the man of talent who selfishly hid his talents in a napkin and gave nothing and the men who brought energy and determined perseverance to bear upon the work they were called to, helping on the advancement of the world in knowledge, truth and theory in its highest sense, as considered in its derivation from *theos*. The chairman at the meeting when the paper referred to was given, Archibald Thomson, was well known among engineers a decade ago. Another paper we are tempted to quote from as illustrative of the thoughtful mind and the eager desire for the well-being of the race: "It is the high privilege of man to have the run of the workshops of the Almighty, to be permitted to examine the self-acting tools, which are silently in operation in every corner of this vast universe, to admire the matchless skill of that irresistible energy, which works in billions of billions of little tracks unerringly, in every grain of sand or sparkling drop of dew, in every leaf or bud or flower, and sun and star, and chiefly where, with life and breath and brain, He has produced man in His image; we who are here to-day, our fathers who before us lived, and men in every age, who have built up the story of the Master's works, unto the present time, while ever learning, bit by bit, to imitate Him in His work. One day perhaps an amber bead found on the workshop floor has lain there for centuries, is picked up, a bauble ornament for child or savage; to make it fit for Roman dame its sides are ground and rubbed, and then 'tis found that, magic-like, it draws unto itself a hair or thread. . . ." "Before me I see the hope of many a homestead; young men with exceptionally favourable opportunities for getting on in this busy striving world, young men who are, many of them, I hope, to make their mark, and some of them, perhaps to leave it behind them, written in the chronicles of their country. It is an honourable ambition to hope one day to be distinguished for good among your fellows, to be perhaps, the poor wise man who shall deliver the city, or to climb by industry and study to a position of affluence, and thereby win the power of doing good to those who have been less fortunate than you in the race for wealth. I desire, however, to impress upon each one of you that although, as Solomon says, 'An advantage for giving success hath wisdom' yet its excellency does not consist in this, and to seek wisdom or knowledge for the sake of success only is to court disappointment." There are many other passages and papers which might be quoted with interest but meantime we close our memorial of one whose genius and personality will live in the minds and memories of all who ever met him, either at the examination desk, the meetings of societies, or in the inner friendly circle where he was best known. Among other interesting papers which have been listened to with delighted interest is: "The Pillar of Cloud by Day and of Fire by Night." It was announced that a series of lectures by the late Mr. Gray would be given at the Institute of Marine Engineers, commencing last October but on account of his failing health these were cancelled the quotation last given is taken from what was intended as the opening lecture. He took a very deep and warm interest in the Institute of Marine Engineers and was closely associated with it from the first; his was one of the names signed to the Articles of Association when the Institute was incorporated in 1889. He was one of the vice-presidents and maintained his interest till the close of his life.

Photo by Mr. W. Lawrence, Dublin

Mr. John Macfarlane Gray,
Vice-President Institute of Marine Engineers.

James Howden, Jr.—Sympathy will readily be felt for, and extended to, the firm of James Howden & Co., Scotland Street, Glasgow, and its well-known principal on account of the death, in his 26th year, of Mr. James Howden, Junr., B.Sc. The sad event took place at Montrieux, Switzerland, on January 14th, the cause, it is believed, being enteric fever contracted before he left his native city of Glasgow, where, recently, there has been a serious outbreak of this disease. Mr. Howden, who was the elder son of Mr. James Howden, left Glasgow on December 10th along with his brother and sister and Mr. J. Howden Hume, a director of the company, and took up residence at Villars sur-Ollon, anticipating a pleasant holiday among the Swiss mountains. About a week after their arrival Mr. Howden became ill, and when the symptoms assumed a more serious form he was removed to Montrieux, where he received the best medical advice available. It was two weeks later, however, before his illness was pronounced to be enteric fever, and to this malady he succumbed on the 14th January as stated. Mr. Howden was a young man of exceptional promise, and in

addition to serving the full term of apprenticeship, he took the science course at Glasgow University, and about two years ago graduated Bachelor of Science.

David McGee.—We place on record, with much regret, the death of Mr. David McGee, local director and shipbuilding manager of the renowned establishment of Messrs. John Brown & Co., Clydebank, the sad event taking place at his residence of Melbourne House Dalmuir, on January 17th. Mr. McGee, who had been ill with influenza and erysipilas for about six weeks, was in his fifty-first year, and began his connection with shipbuilding in the yard of the defunct firm of Messrs. James & George Thomson, when they had their yard in Govan. His father for many years was head foreman joiner with the firm, and he began as an office boy, rising by dint of perseverance and natural abilities through all the different stages of shipbuilding experience. With many of the existing staff he went to Clydebank when the Thomson firm laid out their new establishment there about the year 1880. He rose to the position of under-manager to the late Mr. Samuel Crawford, on whose departure, in 1893, to take up a partnership in and the management of Kinghorn Shipyard, he was promoted to the managership. This was while the British battleship *Ramillies* was undergoing completion. He retained his position during the period the business was carried on under the name of the Clydebank Shipbuilding and Engineering Company, and fully seven years ago when the establishment was acquired by Messrs. John Brown & Co., Ltd., of Atlas Works, Sheffield, he was made a director of the works. Ingenuity and practical thoroughness, with marked powers of initiative and administration, characterized Mr. McGee in all his work, and the many battleships, cruisers, first-class ocean liners and high-class Channel steamers which have been completed during his term of management are eloquent testimony to his abilities. The latest and greatest of these productions, of course, was the Cunard turbine liner *Lusitania*, and with this great vessel the name of Mr. McGee no less than those of his associates in the management of the Clydebank concern, Mr. John G. Dunlop, managing director, Mr. Thomas Bell, Engineering Manager, Mr. W. J. Luke, naval architect — will long be honourably connected. Deceased was held in high esteem by every member of the staff at Clydebank and in every department of the works, and his presence and counsel inspired confidence in the carrying out of every important contract. He was a member of the Clyde Shipbuilders' Association, and three years ago was elected chairman. In this important position he always evinced readiness to take a fair and moderate view on points of dispute between the masters and men. He was a member of the Institution of Naval Architects, and a member of Council of the Institution of Engineers and Shipbuilders in Scotland, and in connection with the latter institution he took an active part in the work of the committee in charge of the erection of the Institution's fine new buildings now nearing completion, in Elmbank Street, Glasgow, which were illustrated and described in our issue for April last. He took a deep and personal interest in the public affairs of Clydebank and district, being a member of the County Council of Dumbartonshire and of the School Board of the parish of Old Kilpatrick. His advice and counsel were at all times available in matters connected with educational work, and especially with the evening science classes. Mr. McGee's demise, in the prime of life and in the thick of active enterprise and industry, is mourned by a widow and three sons, as well as by a large circle of friends and business acquaintances on Clydeside.

REVIEWS.

Der Beruf des Schiffs Offiziers in der Handelsmarine. Von Professor Dr. F. Bolte. Berlin. Konrad W. Mecklenburg. 1907.

THIS is the first volume of a nautical series issued under the editorship of the above author. The work is not of a pretentious character, but the writer, being at the head of the navigation school in Hamburg, is naturally fully acquainted with the subject he has in hand. We see, for instance, where navigation schools are established throughout Germany and the curriculum that has to be passed by those who wish to gain certificates. This latter is given in most minute detail. The books that are advised to be studied are all named, and we see before us one of the reasons for Germany making such progress in the shipping way from the number of aspirants there must be for command and the strictness of the course. It is noticeable that the English language is a qualification as well as the native, and the instruction is practical enough to embrace at a Hamburg school a fully-rigged ship in the grounds, while in another case there is a sea-going training ship. The North German Lloyd has a school ship of its own the entry and rules for which are given. We find in these pages the rules governing all ranks in the mercantile marine with the rations allowed. We may take it that this little book gives a very fair idea of the system that obtains and governs the German mercantile marine, and will be found valuable accordingly.

Steamship Coefficients, Speeds and Powers. By C. F. A. Fyfe. London: E. and F. N. Spon, Ltd. 1907.

THE author puts forward this pocket book for the use of engineers, shipbuilders and those concerned in steamship construction generally, and he says he provides a collection of actual results for reference when determining the power necessary to propel a vessel at a certain speed and the fineness of form appropriate to that speed. He follows Froude's principles, in fact, and defines just the terms employed, explaining tank experiments and the formulæ employed in connection therewith. The Admiralty constant is studied, with the methods of application and the various corrections. A table of multipliers is found for applying the law of comparison, and others of the two-third powers of numbers and the ratio of knots, miles and kilometres, also those for skin H.P. per 1000 ft. of wetted surface.

Papers read at the Institution of Naval Architects are largely drawn upon, as may be supposed, and results of trials given on models in tabular form. These are not only English, but from foreign sources. Actual steamship data follow, drawn from every maritime country and trials of 100 ft. models in the same way. In the appendix, we find several calculations that the subject renders necessary in the way of exemplification, and there are no less than thirty-one plates showing plotted curves in connection with the tables comprising the body of the work. This is a most useful book, and we should say it is one that no naval architect can very well afford to be without. It brings the subject dealt with quite up-to-date.

Liquid and Gaseous Fuels. By V. B. Lewes. London: Constable & Co., Ltd., 1907.

THE author disclaims any idea of superseding standard works already in existence, but in view of the importance of the question at the present time for automobiles and even for steam boilers endeavours to bring the subject up-to-date. He opens with the explanation of the theory of combustion, his definition being that it is the generation of energy and heat by extremely rapid chemical combination, brought about by the ignition point of the substances entering into the combination being attained. In this connection we have the properties of carbon dioxide and monoxide emphasized. We have also the light effects for different degrees of temperature with the constitution of smoke. The action of oxygen as a life and combustion supporter with the values of various kinds of fuel and their constituents and origin follow. Next the calorific values are given, found by means of a calorimeter. The different types of these instruments are shown. Liquid fuel and its varieties find a prominent place here with the regulations of Lloyd's for carrying in bulk, and the methods of test. Important are the several types of burners too and they are fully noticed. The relative merits of oil and coal as fuel are discussed and the manufacture of coal gas explained fully with the process of enrichment sometimes adopted by adding water and oil gas mixed. The use of coal gas for heating and power is then discussed and we find a history of water gas and how it is made after different processes. Producer gas then comes in for attention, according to several methods, and the author attempts to predict the fuel of the future and for this purpose he gives the B.T.U. of all classes in actual figures. He shows that the subject is intimately associated with the engine in which it is used and not necessarily with the calorific value of the class of fuel itself. We are, however, left from the figures presented to form conclusions for ourselves as to what the future has in store for coming generations in the way of fuel. The work, however, is of a distinctly valuable character and will prove useful to all those, and they are many, that are interested in fuels of every kind.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Labrador.—On January 7th, there was launched from the shipyard of Messrs. Cochrane & Sons, Selby, a handsomely modelled steel screw steam trawler, the principal dimensions being:—Length between perpendiculars, 155 ft.; overall length, 165 ft.; breadth extreme, 25 ft.; depth moulded, 14 ft. The vessel has been built to the order of Mr. Joseph Huret, of Boulogne-s-Mer, and is the largest steam trawler afloat, and constitutes a record for the builders in this respect. She is replete with all the latest improvements for the fishing industry, is to be supplied with an electric light installation throughout, and the holds are insulated with cork, etc., for the preservation of the fish. She will be fitted with powerful triple expansion engines by Messrs. Amos & Smith, of Hull, having cylinders 14 in., 23 in., 38 in. by 27 in. stroke, with boiler 14 ft. by 11 ft., 180 lbs. pressure. As the vessel left the ways she was gracefully christened the *Labrador* by Miss Whitfield, of Selby, after which the company adjourned to the builders' offices, where refreshments were served and the customary toasts given and responded to. As a proof of the expeditious delivery Messrs. Cochrane & Sons make a point of giving, this trawler of exceptionally large dimensions has been launched within the short space of ten weeks from date of contract, and is to be delivered in Hull to receive her engines in 3½ months from the contract date.

Fernhill.—On January 15th, Messrs. Richardson, Duck and Co. launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length overall, 313 ft. 6 in.; breadth extreme, 42 ft. 6 in.; depth moulded, 22 ft. 4 in.; gross tonnage, about 2400 tons. This vessel, which has been built to the order of Messrs. W. J. Tillett & Co., of Cardiff, will take Lloyd's 100 A1 class and has been built under special survey. She is of the single-deck type with clear holds, extra large self-trimming hatchways, and is arranged to meet all the latest Admiralty requirements for fleet colliers. Poop is fitted up for accommodation of captain and officers, engineers being berthed in houses on bridge deck and crew in topgallant forecastle. A cellular double bottom and peak tanks are fitted for water ballast and equipment includes four large steam winches of special type, five 10-ton derricks, masts being fitted with derrick tables and cross trees; horizontal multitubular donkey boiler, steam windlass with quick-warping ends, stockless anchors, steam-steering gear etc., etc. The winches and windlass are arranged to exhaust through copper exhaust-pipes into a winch condenser, which is fitted with an independent circulating pump. The engines by Messrs. Blair and Co., Ltd., have cylinders 22½ in., 37 in., 61 in. by 42 in. stroke, steam being supplied by two extra large single-ended boilers having a working pressure of 180 lbs. During construction the vessel has been superintended by Mr. E. J. Caiger, of London. As the vessel left the ways she was christened *Fernhill* by Mrs. W. A. Tillett, of Penarth.

Kamfjord.—On January 16th, Messrs. Robert Thompson and Sons, Ltd., launched from their Southwick Yard the finely modelled screw steamer *Kamfjord*, built to the order of Lars Christensen, Esq., of Sandefjord, Norway, to take the highest class in Det Norske Veritas, her principal dimensions being:—Length B.P. 180 ft.; breadth, 30 ft., and depth, moulded, 14 ft. 6 in. The erections consist of long poop and forecastle, both available for carrying cargo. There are two extra large trimming hatches, with four powerful steam winches by Messrs. Clarke, Chapman & Co., Ltd., worked with steam from vertical multitubular donkey boiler by Messrs. Cochran & Co., Annan Ltd., placed in recess in stokehole. The machinery being fitted aft, one large and spacious hold is left clear of all obstructions for stowage of cargo and to facilitate rapid loading and discharging the vessel is fitted with double derricks the masts having tables on the deck and cross trees on mastheads, to allow derricks to swing well clear of ship's side. Ample water ballast is provided in cellular bottom and fore peak, the former being divided longitudinally and athwartships for trimming purposes. The accommodation is large and commodious for the class of vessel, with provision for captain, a few passengers and dining saloon, in a steel deck house on the poop, the saloon being tastefully fitted up in oak. At forward end of long poop above saloon house, is the lower flying bridge, upon which is erected a large steel chart and wheelhouse, with upper flying bridge above. The officers' and engineers' berths, with large mess-room, etc., are placed in steel houses alongside of casing, and the seamen and firemen's quarters with separated mess-room are in aft part of poop, under which is laid a covering Litosilo. Steam heaters will be fitted in all berths and mess rooms, the vessel being intended to trade in the cold waters of the Canadian seaboard. The steam windlass and a patent steam warping capstan have been supplied by Messrs. Emerson, Walker and Thompson Bros., Ltd., and the combined steam and hand-steering gear by Messrs. Robt. Roger & Co., Ltd. The engines are of the triple-expansion type by Mr. Geo. T. Grey, of South Shields, having cylinders 14½ in., 24 in., and 39 in. with a stroke of 27 in., steam being supplied by a large boiler working at 180 lbs. pressure. After a successful launch, the christening ceremony being gracefully performed by Mrs. F. G. Wainwright, of Sunderland, the owner and party returned to the offices of the builders, where light refreshments were partaken of, and the usual toasts proposed and responded to.

Frankenwald.—On January 20th, Messrs. Furness, Withy and Co., Ltd., launched from the Middleton Shipyard, Hartlepool, the third of three large passenger steamers for Messrs. The Hamburg-Amerika Line, the vessels being 366 ft. long and built to Germanischer-Lloyd and See Berufs Genossenschaft Rules for ocean-going passenger steamers. The vessels are intended for the West Indian trade, and will be rigged as two-masted fore and aft schooners, built on the deep frame principle, with two complete steel decks and long bridge, poop and forecastle, with long boat deck amidships. All weather decks are sheathed with teak. The hull is divided into ten water-tight compartments by means of nine water-tight bulkheads fitted in accordance with German Board of Trade requirements for ocean passenger steamers. Cellular double bottom extends the full length of holds and engine and boiler space for water ballast, the fore and after peaks being also available as trimming tanks. There are five large cargo hatches worked by eleven powerful steam winches, the latter supplied and fitted by the builders, and seventeen derricks two of these are capable of lifting 15 tons each. These steamers will be lighted throughout by electricity, and the installations, consisting of two fine dynamos each, will be supplied and fitted by the builders. The 'tween decks are arranged to carry 608 third-class passengers, and are fitted with Hoskins' patent Neptune berths, whilst 30 first-class passengers will be accommodated in the bridge. A fine dining-saloon, smoking-saloon and ladies' rooms are arranged on the bridge deck. The poop is fitted up as a hospital. The crew are berthed in the forecastle, while the captain and officers are berthed in a large deck-house on the boat deck. Engineers' berths, stewards, stewardesses, butcher's shop, baker's shop, galley, etc. are arranged on the bridge deck. Insulated store-rooms are fitted up in the after hold and 'tween decks, and refrigerating plant will be supplied in each case by Messrs. J. & E. Hall, Ltd. Triple-expansion engines are being supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, with cylinders 25½ in., 43 in., 72 in. by 48 in. stroke, steam being generated in three single-ended boilers 14 ft. by 12 ft. long, working at a pressure of 200 lbs. per square inch. Howden's system of forced draught will be fitted in connection with the boilers.

Jervaulx Abbey.—On January 20th, Messrs. William Gray & Co., Limited, launched at West Hartlepool the finely modelled steel screw seamer *Jervaulx Abbey*, which they have built to the order of Messrs. The Hull and Netherlands Steamship Co., Limited, Hull. The vessel is similar to the *Whitby Abbey* recently launched by the builders, and will take the highest class in Lloyd's Register, and her dimensions are:—Length overall, 265 ft., breadth, 33 ft. 8 in., and depth, 16 ft. 3 in. She has a full poop, raised quarter deck long bridge and topgallant forecastle. A handsomely fitted out saloon, smoke-room and cabins for forty-four first class passengers will be fitted in houses on the bridge and accommodation for twenty-eight second-class passengers in the poop and forty four steerage passengers forward. An installation of electric lighting, electric bells steam heaters, etc., will be provided, and the

bridge fitted up for the carriage of about forty horses. The hull is built with deep bulb-angle frames, a cellular double bottom and peak tanks, large hatchways, five steam winches, steam-steering gear, steam capstan aft, steam windlass and a complete outfit for a first-class passenger and cargo steamer. The machinery, which is being made by The Central Marine Engine Works of the builders, has been designed to give the vessel a speed of at least 15 knots per hour, the engines having cylinders 25½ in., 40½ in. and 67 in. diameter, with a piston stroke of 42 in., embodying special features to give the required power without unduly increasing the weight. Three boilers to work at a steam pressure of 185 lbs. are of the Central Marine well-known type with flanged shell; they are fitted with Howden's system of forced draught and internal feed heaters. The engine-room will be fitted up with numerous auxiliaries which will add to the efficiency of the machinery. The vessel and machinery have been built under the superintendence of Mr. W. H. Broderick on behalf of the owners, and the ceremony of naming the steamer *Jervaulx Abbey* was gracefully performed by Miss Nellie Barraclough, Seaton Carew.

General Guerrero.—This vessel was launched on January 23rd by Vickers, Sons & Maxim from their Naval Construction Works at Barrow-in-Furness, and although officially designated a transport, may be regarded as an important addition to the fighting fleet of the Mexican Government. The vessel carries six quick-firing guns of 4 in. calibre of great power, and two 2·24 in. quick-firing guns, all placed at a high level above the water-line and supplied with ammunition from the magazines by means of electrically-operated hoists, communicating direct with the gun positions. The coal bunkers, too, are arranged as far as possible for protecting the machinery. In some other respects the ship corresponds to the naval practice applied to unprotected cruisers, although the transport of troops and their impedimenta was the main aim of the design. Thus she takes 550 men on the lower deck. The officers are accommodated on the main deck. Forward on this level there are stalls for forty-five mules or horses. Strong derricks are fitted on the masts, and steam winches on the deck for the shipping of field guns and other heavy weights. Ventilation of the various quarters has had special consideration, and, in addition to the usual sources of supply of air, electrically driven fans are fitted to the various compartments. Electric light is, of course, arranged for throughout the ship. There are large quarters for the men. The officers have special cabins and saloons. A well-equipped hospital forms a prominent feature. A refrigerating plant is fitted in the hold, and cold stores are built in the ship for provisions, etc. In a word, the vessel on limited dimensions and draught affords all the conveniences of the considerably larger ships of the class built by the Vickers Company. The principal dimensions of the vessel are as follows:—Length between perpendiculars, 245 ft.; breadth moulded, 35 ft.; depth moulded, 17 ft. 6 in.; displacement (about), 1850 tons. The vessel is built of steel, is classed 100 A1 at Lloyd's, and has been constructed under the supervision of a Special Commission appointed by the Mexican Government. The accommodation for the crew is entirely separate from the quarters for the troops. The vessel is propelled by one set of direct-acting, vertical, triple-expansion three-crank engines, capable of developing 1200 I.H.P. The diameters of the cylinders are H.P. 20 in., I.P. 31 in., L.P. 50 in., and the stroke is 36 in. in each case. The condenser is of cast iron, is placed at the back of the engines and is supplied with circulating water by an independent centrifugal pump. Steam is supplied by two boilers of the single-ended cylindrical type, 12 ft. 6 in. dia. by 10 ft. 9 in. long, constructed for a working pressure of 175 lbs. per square inch and arranged to work under Howden's system of forced draught. The vessel is schooner-rigged with two masts, has one funnel, has a cruiser-shaped stem and stern, and, when completed, will have the appearance of a small cruiser. The launching ceremony was performed by Madame Covarrubias, wife of His Excellency the Minister Plenipotentiary of Mexico in England.

Ocean.—There has lately been launched from the shipbuilding yard of Messrs. William Dobson & Co., at Walker, the large steamer *Ocean*, built to the order of Mr. P. A. Gron, of Sandefjord, Norway. This vessel is built on the "cantilever" system by arrangement with Sir Raylton Dixon and Co., under the Harroway and Dixon, John Priestman and Livingston and Sanderson patents. The dimensions are:—Length between perpendiculars, 360 ft.; breadth 52 ft.; depth moulded, 28 ft. 4 in., the deadweight capacity being over 7000 tons on a light draught of water. The loading and discharging arrangements are exceptionally complete, there being ten derrick posts carrying twenty derricks. In addition to the usual double bottom arrangements a large quantity of water ballast is carried in topside tanks, which also make the vessel entirely self-trimming, the holds being absolutely clear of pillars or beams. The propelling machinery is placed at the after end of the vessel and is being constructed by the North-Eastern Marine Engineering Co., Ltd., of Wallsend. The cylinders are 26 in., 42 in. and 70 in. diameter by 48 in. stroke, and there are three boilers, 180 lbs. pressure, fitted with Howden's system of forced draught.

Cochran (**Annan**) donkey boilers with patent seamless furnaces have been supplied to the following vessels:—The *Evangeline*, *Luscany*, *Arabiana*, *Manco* and *Tuscany*.

TRIAL TRIPS.

H.M. Telegraph Ship Alert left the yard of Day, Summers and Co., Limited, at Northam Ironworks, Southampton, and after a satisfactory trial run to Cowes proceeded to Dover. This vessel has had an extensive machinery repair and general overhaul, the crank-shaft being lifted and main bearings renewed together with a considerable amount of other work.

Redwood.—On January 4th, the screw steamer *Redwood* (of which we gave particulars in our January issue, page 268), built by the Blyth Shipbuilding Co., Ltd., for Messrs. the Tyneside Line, Ltd. (Messrs. J. Ridley, Son & Tully, managers), of Newcastle-on-Tyne, was taken to sea for trial. Triple-expansion engines of good power have been fitted by Messrs. North-Eastern Marine Engineering Co., Ltd., of Sunderland, cylinders 19 in., 31 in., 51 in. by 36 in. stroke, one boiler 16 ft. by 10 ft. 6 in. working at 180 lbs. pressure. The *Redwood* was run several times over the measured mile and good results were obtained, the representatives of owners, builders and engineers on board being highly satisfied with the speed, also the smooth working of machinery.

Slieve Bloom.—The trial trip of the s.s. *Slieve Bloom*, built at Barrow by Vickers, Sons & Maxim, passed off very successfully in the Irish Sea. The vessel which was built for the London and North-Western Railway Co., was designed for a speed of 16 knots, but she exceeded this by a knot. Her owners were very pleased with her performance, and they hope to get equally satisfactory results for her sister ship *Slieve Gallion*, which will be delivered to her owners in the course of about a month.

S. T. Taylor & Sons have covered the boilers, pipes, etc., of the following vessels:—*The Belle of Spain*, *Westwood*, *Keyingham*, *Inverki*, *Walkure*, *Norton*, and *Guyanne*, with their "Tynos" non-conducting material, and the boiler bottoms of the *Ipiabata*, *Borborema* and *Ladywood* with their "Tynos" patent removable asbestos mattresses.

David Joy & Cooper, of Southampton, have fitted their patent assistant cylinders on H.M.S. *Lord Nelson*.

H.M.S. Swift.—The new 36-knot torpedo boat destroyer lately launched by Messrs. Cammell, Laird & Co., at Birkenhead, was coated with Holzapfel's anti-corrosive and anti-fouling compositions. Messrs. Holzapfel, besides the *Mauretania*, the fastest merchant vessel, and the *Tartar*, the fastest war vessel so far tried, will also have the *Swift*, which probably will prove faster than the *Tartar*. Considering that the *Tartar* was one of a number of similar vessels, her remarkable speed record reflects the greatest credit on all concerned.

Thorn's School of Marine Engineering, North Shields. At the examination for Extra First-Class Engineers, held on January 14th, 15th and 16th, the following were successful:—Mr. J. Thomson, of Southampton; Mr. E. R. Wales and Mr. R. Huntley, of Hull; and Mr. R. J. McLeod, of West Hartlepool. All these candidates were prepared by the postal system of tuition, introduced by Mr. W. H. Thorn, and three passed the first time up, the first-named obtaining the very high number of 700 marks out of a possible 800. It is

interesting to note that out of the last 76 successful Extra Firsts from this school, 39 were prepared by correspondence, and out of these the extraordinary number of 31 passed the first time of going up, proving conclusively the thorough efficiency of the system as carried out by W. H. Thorn & Son, 5, Waterville Terrace, North Shields, from whose establishment there have now passed 163 Extra Chiefs, 29 Surveyors and over 6800 Chiefs and Seconds, this being a record unsurpassed by any other school in the kingdom.

Institute of Marine Engineers.—The Institute of Marine Engineers had their conversazione in the King's Hall and Throne-room, Holborn Restaurant, on Friday, January 24th. A concert in the Throne-room occupied the former part of the evening from seven o'clock till nine, and the large assembly greatly appreciated the various selections, which included songs by Misses Esther Yunson, Maggie Inglis and Hettie Stammer, recital by Mr. W. B. Purdie, songs by Messrs. A. G. Carpenter and Will Tebbutt; pianoforte solo by Mr. Leon Foulon, who also acted as accompanist. Being the eve of the Burns' anniversary, Miss Inglis sung by request "Whistle and I'll come tae ye, ma' lad," and "The Cotter's Sarutday Night" was well recited by Mr. Purdie. Mr. W. L. Cockburn, who arrived from a concert at Brighton after twelve, aroused great enthusiasm in the interval of the dance in the King's Hall with his powerful rendering of "Sound the Pibroch" and "The March of the Cameron Men." The dancing commenced in the King's Hall at 9 p.m., and was continued till 3 a.m. The music by the 3rd Kent Royal Garrison Artillery String Band, under the direction of Mr. E. Campbell, was excellent in quality and time. Simultaneously with the dancing, selections of vocal and instrumental music in the Throne-room afforded another pleasant means of recreation. The convener for the arrangements was Mr. F. Cooper, R.N.R., member of Council, supported by the hon. secretary and members of committee, who are to be congratulated upon the function proving so enjoyable to all who were present to witness the brilliant assembly. A word of appreciation is due to those members whose efforts in carrying out the details so largely conduced to the general effect, the M.C., Mr. K. Rhodes Mitchell; assistant M.C.'s, Messrs. D. Hulme, John McLaren, J. H. Redman, J. G. Rendall, A. Robertson and G. T. Veness; stewards, Messrs. A. E. Battle, P. Boyd, R.N.R., and A. H. Mather; director of ceremonies for the concert, Mr. Wm. Lawrie, ; stewards, Messrs. Jas. Adamson, J. G. Robertson and R. Balfour. The other members of committee were Messrs. Geo. Adams, J. Blelloch, W. Britton, Aitken Brown, P. T. Campbell, John Clark, Thos. Drewry, W. E. Farendon, J. G. Hawthorn, W. Howell, J. Lang, R.N.R., R. Leslie, R.N.R., J. T. Milton, J. M. Morton, J. H. Redman, A. W. Robertson, R. W. Ross, A. W. Seabrook, and J. Weir. During the evening a flash light photograph of the gathering was taken by Messrs. Fradell & Young.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class; 2C Second Class.

November 30th 1907.

Adam, Andrew 1C Greenock
Anderson, R. D 1C Aberdeen
Baker, James B. 1C N Shields
Baxter, John .. 2C N.Shields
Booth, H. E .. 2C Sunderl'd
Bothwell, John 1C Aberdeen
Clegg, Arth. E. 1C Lond n
Edgar, Charles 2C Liverpool
Evans, D. E. J. 1C Sunderl'd
Fell, C. F. R. 2C N Shields
Gray, James .. 2C Greenock
Harbon, Herbt 1C Hull
Hepburn, Alex 2C N Shields
Henning W. J 1C Liverpool
Hunt Wm F 2C Liverpool
Isaac, Gilbert J 1C Bristol
Johnson, J. W 2C Sunderl'd
Johnstone, Geo 1C Liverpool
Jones Paul C 1C London
Kynoch, Henry 2C Liverpool
Lane, Stuart .. 2C Bristol
Lanecake, Thos. 2C N Shields
Linston, Jas. R 2C Sunderl'd
Martin, W T 2C Bristol
Mascas, Alex. 2C Greenock
M'Kay, D B .. 1C Aberdeen
M'Lachlan, F. 2C Hull
Monro, D. T... 1C Aberdeen
Mullens, Ed .. 1C London
Nicholl, Benj. 2C Sunderl'd
Nickson, A F 2C Liverpool
O'Donovan, George S 2C Liverpool
Oostermeyer, G 2C London
Owen, J G H 1C London
Pain, Harry C 2C Dover
Park, Robert T. 2C Greenock
Parry, Chas. P. 2C Liverpool
Paterson P S H 2C Aberdeen
Pease, Chas. E. 1C N Shields
Rasmussen, C 1C Aberdeen
Reid, Alex M 2C Aberdeen
Ross, Alex S 2C Aberdeen
Ryan, F W. J 1C N Shields
Shields, Geo R 2C Liverpool
Smeds, John .. 2C N Shields
Smith, Thos .. 1C N Shields
Sowden, Ed 2C N Shields
Stinson, John L. 1C N Shields
Swan, Karl O. 1C Hull
Swindale, T H. 2C N Shields
Walker, Thos.G 1C Sunderl'd,
Walker, Jas. T. 1C Aberdeen
Watson, Robt. 2C Greenock
Wigham, Wm. 1C N Shields
Wood, John F. 1C Hull
Wright Alex T 2C Liverpool
Young, W E... 1C Liverpool

December 7th

Adam, Alex. .. 2C Leith
Beatty, M B... 1C Glasgow
Boyd, Arthur G. 1C London
Brockbank, T. 2C London
Claireaux, J T. 2C Leith
Cobban, H J. 1C London
Corry, Jas. H. 1C Glasgow
Cook, William 2C N Shields
Crocker Ed J. 1C London
Davies, Evan D 1C Cardiff
Dempster, Wm. 2C Belfast
Fairley, D M'D. 2C London
Galbraith Wm. 1C N Shields
Gollan, J. M C. 2C London
Guthrie, Nigel 2C London
Hankin, H W. 2C Liverpool
Hosken, T. J .. 1C N.Shields
Inglis, George 1C South'ton
Innes, R. M'G. 2C Leith
Jackson, Wm J. 2C Glasgow
Jamieson, G. E 1C Glasgow
Johnstone, O .. 2C Cardiff
Kemp, Harold 1C London
Kirkham, J. A 2C Liverpool
Lord, Perciv T. 2C London
Luke, Tom E. 2C Cardiff
Mankin, T H 2C N.Shields
M'Ferran, John 1C Belfast
Millar, Hy. C 1C Leith
Miller, James .. 1C Glasgow
Morgan, Wm... 2C Cardiff
Mussen, Rich. 1C Belfast
Roddan, Peter 1C Glasgow
Shepherd, C W 2C Cardiff
Stallworthy, George H 1C London
Stanford, Eric S 1C London
Stark, Thos B. 1C N Shields
Thompson J. E. 2C Cardiff
Thomson, Robt 2C Glasgow
Vlartaris, A .. 2C N Shields
Wells, Frank .. 1C Liverpool
Whalley, H G 2C London
White, S J .. 2C N Shields

December 14th

Anderson, G F 1C N Shields
Arnott, Andrew 2C London
Batson, Rich P 1C London
Burn, Robert .. 2C N Shields
Currie, John T 1C N Shields
Daw, Joshua H. 2C Liverpool
Dettmar, J H F 2C London
Forbes, William 2C London
Fricke, J E O 2C N Shields
Garnham W T 1C London
Garrett, A L .. 1C Liverpool
Glass, David C 2C Liverpool
Grierson, John 1C Liverpool
Hall, Alfred .. 1C Hull
Hancock, Albert 1C London
Harrison, W A 1C Liverpool
Hedley, Ralph 1C N Shields
Henderson, J H 2C Greenock
Jones, Thos .. 2C Liverpool
Jones, G M .. 2C London
Kerr, James.... 2C Greenock
Kidley, E W B 1C Liverpool
Lightburn, J H 1C Liverpool
Lowe, Walter P 1C Liverpool
Magee, T R .. 2C Hull
McCullum, H. 2C Greenock
M'Donald, J E 2C N Shields
Morley, R C. 1C N Shields
Morton, Wm. J. 1C N Shields
Piper, Herbert 1C N Shields
Poutons, A. G. 1C N Shields
Reynolds, F. C 1C London
Risoe, Anders.. 1C Greenock
Roberts, Robert 1C Liverpool
Sanders, R C. 1C Hull
Skipper, C N. 1C London
Sutcliff, R. F... 1C Liverpool
Wooler, R. E... 2C Hull
Wyllie, Wm .. 1C Hull

December 21st

Abbley, Andrew 2C W. Hart'l
Aitken, Robt G 2C Glasgow
Anderson, Alf. 1C W. Hart'l
Ash, Horace L. 1C South'ton
Banks, Horace 1C London
Bell, John .... 2C N Shields
Bernard. Thos. 2C Glasgow
Brown, C. T. .. 1C Glasgow
Cameron, Jas. S. 1C Glasgow
Chambers, G.W. 1C W Hart'l
Chilver, C. W. 2C Cardiff
Chipchase, R H 2C W. Hart'l
Cranston, J C.M 2C Leith
Cromarty, J A. 1C London
Ellis, Reginald 1C South'ton
Farnie, L. J. J. 2C London
Gair, Robt W. 2C N.Shields
Garner, George 2C London
George, James 1C Glasgow
Hall, Edwd W. 2C Liverpool
Halliburton, W. D. H. 2C Cardiff
Harris, Wm E 2C Cardiff
Harvey, Edmd. 2C South'ton
Hope, Wm. H. 2C W. Hart'l
Ions, R. Macl 2C W. Hart'l
Jenkins, H J .. 1C Cardiff
Jones, William 2C South'ton
Law, Wm. T .. 1C Glasgow
Leggat, Jas. W 1C London
Livingstone, J K. 1C Barrow
Lloyd, Hugh O 2C Liverpool
Lowcock, W J. 1C W Hart'l
Luff, Oliver S. 2C Cardiff
McArthur, J H 1C Glasgow
M'Callum, C. S 1C Leith
Millar, T. C. O 1C Glasgow
M'Fadyen, A C. 2C Glasgow
M'Millan, M .. 1C Leith
M'Nally, Thos 2C N.Shields
Montgomery, Jas A 2C Glasgow
Nicoll, And R 2C Leith
Olsen, Oscar G 2C Leith
Oram, Wm. J. 1C Plymouth
Pounder, Alfred 1C W Hart'l
Richards, T J 2C Cardiff
Ritchie, John .. 2C Leith
Sackett, H L .. 1C Liverpool
Secombe, Wm. 1C Cardiff
Seymour, S. H 1C South'ton
Shorts C. W .. 1C London
Sowerby, J. W. 2C W Hart'l
Spedding, M. J. 2C Liverpool
Stark, Geo H. . 2C London
Tessier, Louis.. 1C Glasgow
Thirlwell, R G 1C N Shields
Thomas, Alf C. 2C N Shields
Thomas, W.G F 1C London
Thompson, H 1C W. Hart'l
Thorne, A J. .. 2C Cardiff
Turpie, Jas..... 1C N Shields
Williams, Wm 2C Cardiff
Williams, J H 2C Liverpool
Williams, Wm 1C Liverpool
Wood, Herbt. J 1C Barrow
Woods C. W... 2C W Hart'l
Wright, Jas. .. 2C South'ton
Young, Alf G 2C South'ton

The Marine Engineer

And Naval Architect.

LONDON, MARCH 1, 1908.

THE two lectures delivered to the Institute of Marine Engineers by Mr. J. T. Milton, Engineer-in-Chief Lloyd's Registry, on "Copper and Copper Pipes," re-opens a question which has been keenly discussed and laid to rest from time to time by the adoption of different methods and materials to overcome the difficulties of the situations as they occurred. The failure of a steam-pipe is disquieting, even when it occurs in the ordinary course of examination, of testing, or of gradual warning while in actual service; but when the failure occurs suddenly it is often disastrous in its effects. The subject dealt with is of very great importance, and it is one which every engineer should study and know more about than he has an opportunity of learning during his apprenticeship or workshop experience. The discussions which took place on the conclusion of the lectures elicited some useful information, and it is at discussions such as these that engineers can obtain valuable data to guide them in critical times. The purity of copper is a matter of the utmost value to electrical engineers, and the tendency has been to meet this by manufacturers; but in attaining practically absolute purity it would appear that elements have been eliminated which were valuable in other directions in which all engineers are concerned, and especially in the manufacture of pipes. That this is known and recognised by manufacturers and users to some extent is valuable information, in the sense that what is known and recognised as not a good feature ought to be avoided. The insufficiency of the electro-deposited copper tube to meet the requirements of steam-pipes may be an illustration of one aspect of the subject, but there seems no reason why this system of manufacturing pipes should not be improved upon in the direction which experience suggests. Reasoning by analogy it is not good for one metal to be quite alone; when unwedded it misses a wider vocation for the ordinary purposes of its life. The work of the designer of pipe arrangements, so that freedom may be allowed for the pipes to adjust themselves under heat or cold, is manifestly an important element; the coppersmith has a responsible duty in seeing that his share in the making of the pipe is up to the highest standard of quality. Next comes the erector, who may mar the whole by anchoring the pipe-line improperly or securing it rigidly. Yet, even beyond all these, comes the engineer, whose inattention to drains brings trouble and danger when under unavoidable circumstances one section of pipes is closed by a stop-valve and another section open to the steam, then the connecting valve which unites them is opened with drains shut, when water-hammer ensues, with probably a burst pipe.

The question of annealing steam-pipes periodically hinges largely on the method of carrying out this properly, and there is no doubt that annealing is good for a pipe which has suffered fatigue; but the heating should be uniform, preferably in a furnace. It may be debatable as to the temperature of the furnace and the time required; on these two details different views are expressed by coppersmiths, still it seems clear that a heat nearing 900° F., with uniform exposure for an hour before cooling off, gives a new lease of life to a pipe.

SUPERHEATING OF STEAM.

A PAPER on the superheating of steam, by Mr. Thomas Sugden, was read at the meeting of the Association of Engineers in Charge on February 12th. The author pointed out that while improvements have been made in effecting economies in the methods of using steam, in the introduction of higher pressures and in the details of machinery design and material which, combined, have produced results of great value and importance, leaving indeed small room for further gains, the question of the steam itself has not received the attention and consideration due to it as the main factor of power in the steam engine. The losses from condensation are considerable, and the nearer that the steam can be brought to a gas the less will these losses become, not only by reason of the lessened liquefaction in the initial stage, but also of the decreased tendency to liquefaction through a long line of piping, when steam is superheated.

The adoption of the gas or internal combustion engine in its various forms is a move in the direction of economy, to get more out of the coal than can be obtained by turning the heat units in coal into steam—an admittedly wasteful process. The competition between steam-engine makers and those who have turned their attention to the perfecting of the internal combustion engine has resulted in efforts being made to further improve the steam engine. That considerable gain can be effected by superheating was pointed out by the author of the paper. The arguments based upon theoretical grounds as to increase in efficiency with corresponding economy had been proved by a series of extended trials, the results of a study of these trials being summarized as follows:—

1 With high-class modern engines there is a marked gain in economy, which is generally not less than 10 per cent.

2 A moderate degree of superheat will effect a considerable saving, but the higher the degree of superheat the greater the gain.

3. Compound engines will, with superheated steam, give nearly as good results as triple-expansion engines; but compound engines, using superheated steam, will work more economically than multiple-expansion engines using saturated steam

4. With highly superheated steam there is less variation in the steam consumption per i.h.p. per hour when the engine is working full, three-quarter, half and quarter load This feature is of considerable advantage where the load is variable
5. Small engines show the greatest gain when using superheated steam, and will work as economically as large engines using saturated steam.

THE ATLANTIC RATE WAR

THE steamship companies of the North Atlantic are much to be congratulated on the termination of the rate war which has raged between them for several months. To the view of the impartial outsider it was impossible that any of them could benefit by its continuance, though it was equally obvious to those who bestowed much thought on the matter that, like the more serious struggles between nations, this contest came into being for reasons to a large measure outside the control of those in whose hands the management of the companies concerned is placed. Steamship managers, like statesmen, hate war on paper; but, like statesmen, they often find that the trend of events is too strong for them, and that, in spite of their hatred of that which tends to diminish profits and to pile up expenses, they are carried unwillingly into the vortex. The predisposing causes towards the late rate war have undoubtedly been the large provision of new and vast steamships on the New York station, though in the end, not only the New York, but even the Canadian lines were brought into the contest. The year 1907 saw unusual additions to the fleets of the mail lines. First of all we had the 25,000-ton *Adriatic*, with her palatial accommodation for such passengers as desired comfort combined with moderate fares and slow speed. Then came the Nord Deutscher Lloyd express steamship—the *Kronprincessin Cecilie*. A month later came the faster and far larger *Lusitania* of the Cunard Line, to be followed by an equally important sister a month later. To take the first saloon alone, it may be said that these four vessels are capable of accommodating with ease two thousand passengers on every trip, or, say, twenty thousand passengers to the westward a year.

The year 1907 was a record year for transatlantic travel, yet the total increase in saloon passengers in the trades in which these companies are engaged was but as follows:

	Saloon Passengers
Cunard Line, Liverpool to New York say	2,900
White Star Line, Liverpool to New York ......say	1,800
Nord Deutscher Lloyd, Bremen and Southampton to New York ......say	1,200

or say five thousand passengers in all. It follows that, for the moment, there is a struggle for travellers to fill the new accommodation provided, and hence the war. The cuts made extended, of course, to all classes of passengers, but the figures given are typical of the enlargement of accommodation for all conditions of voyagers. No doubt in a short time—under normal conditions of national prosperity—the development of traffic will again overtake the facilities offered to the public. For the moment, however, there was a hunger for persons to fill up the new berths, and hence the contest to secure them. After a series of sharp and heavy drops in rates, agreement has been reached between all those concerned, and a fair schedule has now been evolved for the future. Whilst regretting the losses to which the combatants have been put during the continuance of the fight, one can only express satisfaction that the contest came at the slack season of the year, and, further, in a time when, owing to the peculiar conditions of financial affairs on the other side, the number of persons westward bound was for the moment somewhat restricted. Nevertheless the companies concerned must have suffered a marked diminution in their takings.

The Annual Dinner of the Liverpool Engineering Society was held on February 6th, presided over by Mr. Thos. Duncanson (President). There was a good attendance of members and friends. The chairman was supported by Sir W. H. White, Sir Thos. Barr, I. Caton, LL.D. (Lord Mayor of Liverpool), Hon. J. L. Griffiths (U.S. Consul), Sir Chas. Petrie, and Col. Stuart, R.E., etc. The Royal toasts were accorded with enthusiasm. The "Imperial Forces" was submitted by Sir Thos. Barr. Referring to the territorial army scheme, he saw in it much to commend, and expressed the view that the volunteer force of the country would be advanced and strengthened by the development of the scheme. It was important to look to the national defences, the expenditure upon such being as an insurance premium. Col. Stuart, in responding, said that war in the present day was largely a matter of engineering—not strategic, but practical engineering he meant. Engineers were working out weapons, armour, flying machines, submarines and other scientific and technical machinery for offence and defence, and in these directions much of the war of the future would be. He advocated the encouragement by employers of labour of the Volunteer force. "The City of Liverpool and the Trade of the Port" was proposed by Mr. H. E. Clare, who said that the progress and advancement of the city and port were matters for warm congratulation, and that although competition had arisen of late years which threatened to reduce their trade, the increased returns and the improvements made all round were eminently satisfactory. The toast was coupled with the Lord Mayor, who responded, amid great applause, and said that while the prosperity of the city and port had been great and continued, it was largely due to the engineering profession. The Hon. J. L. Griffiths proposed "The Engineering Profession," a toast to which Sir W. H. White responded. He spoke of the aspirations and work of the engineer as being of the noblest character. Imagination and a perception of what is required were, on the one side, in looking forward, and in the realization of any great work there was pleasure, on the other side, when the work was accomplished. The great work performed in Egypt in connection with the Nile had brought about prosperity and good to that country. It was recognised more now than ever that the grip of scientific principles and the solid support of practical experience were necessary for success in engineering work. In the training course of Liverpool University this was recognised, but he considered that until the University had a chair established for naval architecture and marine engineering it fell short of what it should be. The toast of the "Liverpool Engineering Society" was proposed by Sir Chas. Petrie and responded to by the President. The health of the "Guests" was proposed and suitably acknowledged with thanks for the hospitality extended to them.

ANDREWS & CAMERON'S EVAPORATORS AND FEED-HEATERS.

OUR illustrations on this and pages 312 and 313 are concerned with a type of sea-water evaporator and of feed-water heater the design of which is based on principles which, although referred to by such scientific authorities as Professors Macquorn Rankine, Osbourn Reynolds, etc., have not hitherto been brought prominently into practice by engineers, at least in the manufacture of the two important auxiliaries in the engine-room of modern steamers referred to. The evaporator and feed-heater herewith illustrated are made by Messrs. Andrews & Cameron, Kelvin Engineering Works, Kirkintilloch, N.B., and are now being extensively fitted on board passenger steamers and steam yachts. Evaporators which have been at work since the beginning of 1903 have maintained their specified production with remarkable regularity and have required the minimum of attention and cleaning.

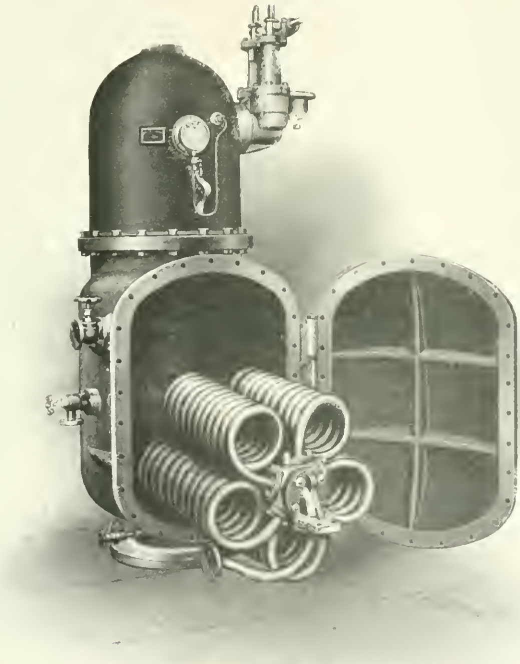


Fig. 1

Rankine pointed out many years ago, when referring to surface condensers, that the rapidity of condensation depended mainly on that of the circulation of the cooling fluid at the other side of the plate. The same authority stated that "the most rapid convection of heat is that which is effected by means of cloudy vapour which combines the mobility of a gas with the comparatively greater conducting power of a liquid." Professor Osbourn Reynolds has done much to elucidate this question, and in one of his early papers on the subject he enunciated the law that "the heat carried off by any fluid from a surface, apart from the effect of radiation, is proportional to the internal diffusion of the fluid at and near the surface, *i.e.*, is proportional to the rate at which particles or molecules pass backwards and forwards from the surface to any given depth within the fluid."

A very simple experiment will show the remarkable effect of diffusion of liquids in the transmission of heat through thin metal plates. Take a glass of cold water, having a small tin vessel filled with hot water immersed up to the same water-level on both sides. Now observe the rate of cooling the hot water under the following conditions: (a) water in both vessels still; (b) warm water still, and cold water stirred up

or diffused, care being taken that the initial temperatures are the same for each trial. From results obtained in this way it has been observed that the rate of transmission when both the hot and cold water are diffused is nearly three times as great as when both are still.

When coils of tube are used for heating water, it is usual to admit steam at the top end of the coil and drain the water of condensation through a drain valve at the bottom. The steam can only pass through the coil at the rate at which it is condensed, and if the drain valve is not open sufficiently to let all the water away, then it must accumulate in the coils until the heating surface is reduced to such an extent that the amount of condensation is equal to the amount of

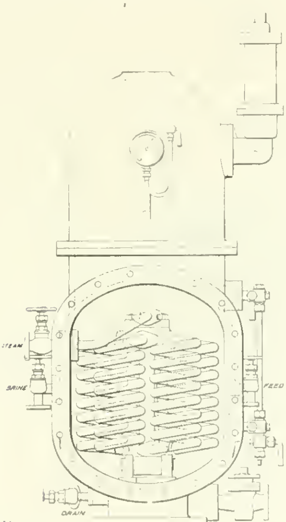
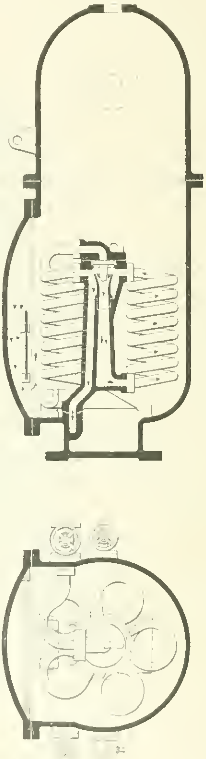


Fig 2

water drained off; or, again, if the drain valve is too much open, then steam must be passing without serving its purpose.

The sea-water evaporator, illustrated by Figs. 1, 2, and 3, has been designed with a view of obtaining a rapid and automatic circulation of the steam and water in the coils, while avoiding the disadvantage of dead water lying therein under any conditions of working. It will be obvious that when the whole of the heating surface is effective the absorption of heat by the surrounding water must be more uniform than when the upper portion of the heating surface only is effective; consequently the circulation of the water is increased, and ebullition becomes less violent at the surface. Given the same quality and density of salt water to evaporate, the principle cause of frothing or priming is violent local ebullition at the water surface; and if the greatest transmission of heat takes place at that point, as it generally does with an ordinary coil, priming is more likely to occur than when the heat is more uniformly transmitted over the whole heating surface.

By reference to the sectional elevation (Fig. 3) it will be seen that a number of copper coils are secured by flanged joints to a centre stand-pipe, the coils being alike and interchangeable. An injector is provided at the top of the stand-pipe, discharging through the stand-pipe to the inlet end of the coils at the bottom; the



Fig

steam then passes up through the coils, and that which is condensed, or part of it, goes down the drain pipe, while the remaining steam and water are drawn into the circuit again by the suction of the injector. Here, then, we have a liquid with the mobility of a gas, the ideal combination for the rapid transmission of heat. This rapid circulation has the additional effect of scouring the heating surface, keeping it free from deposits and rendering it more efficient, and the flexibility of the coils enables the salt scale to be readily cracked off by blowing off and admitting cold water. So effective is this found to be that a trip from Bombay to

Hull, occupying 32 days, has been made with one of those evaporators in daily use without opening the door, and even after such a severe trial the coils did not require cleaning.

The coil standard is hinged at the bottom so that the coils may be turned out for convenience of cleaning, examination, or repair at any time (see Fig. 1), and they are connected up so that they can be tested under steam in sight to ensure that all joints are perfectly

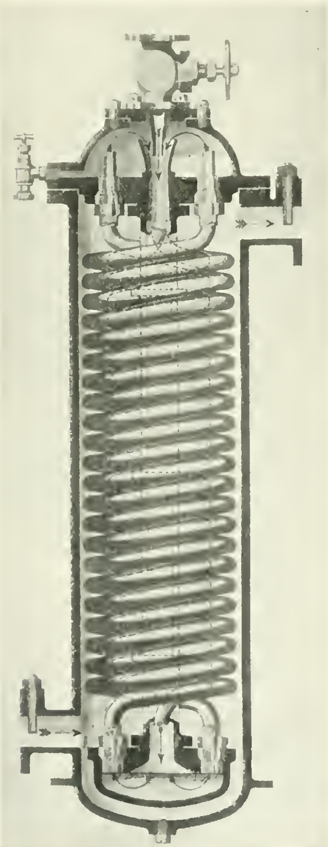


Fig. 4.

tight. If any coil becomes defective, a spare coil can be easily fitted, or, if one is not at hand, the flanges can be blanked off and the evaporator used until a new coil is obtained.

Feed-water heaters are made on the same principle, as illustrated by Fig. 4, from which it will be seen that the centre stand-pipe and coils are secured to the bottom cover, so that the coils can be taken out for cleaning or repair, as in the case of the evaporator. The action is, of course, the same as already described for the evaporator, although both steam inlet and drain are most conveniently situated at the bottom.

In some cases the coils are completely filled with water, into which the steam discharges through the injector, thus heating the water by direct contact and setting it in circulation through the coils at the same time. At each circuit, as it passes through the injector, the water receives a fresh supply of heat

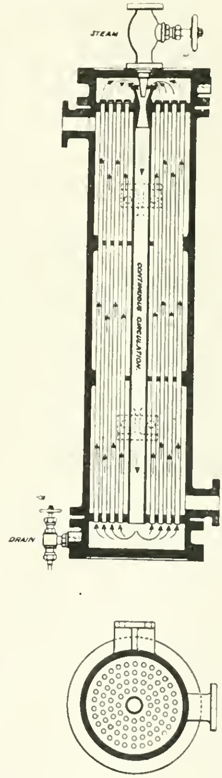


Fig 5

from the incoming steam, and—water being a better conductor of heat than steam—the rate of heat transmission per unit of surface is materially increased. Fig. 5 illustrates a heater of the smaller class and capacity, having straight tubes.

The evaporators and heaters above roughly described have been fitted during the last five years into a large number of passenger and other vessels for the principal shipping companies at home and abroad, the majority being supplied under Board of Trade and Lloyd's surveys.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Union Castle Line

are receiving back their well-known mail steamer *Dunottar Castle* which is still remembered by passengers in the Cape trade, though it is long since she has made a voyage in the mail service, since she has, of course, for some years been superseded by a larger and more luxurious class of vessel. After lying for some time in the Solent off Netley, as second reserve ship for the Cape Mails, she was chartered for a year's service to the Panama Railway Company. That charter having now expired she is at the time of writing on her voyage from New York to Southampton.

The Copenhagen.

On Saturday, the 8th February I had the pleasure of inspecting the new turbine steamship *Copenhagen*, as the guest of the Great Eastern Railway. The trip showed one something of several departments of the Company's activity, for we ran down from Liverpool Street in one of the trains ordinarily employed in connection with their Continental service *via* Harwich. The coaches were a series of fine bogey corridor-vehicles with elliptical roofs, amongst them being some of the restaurant cars, whose cuisine has obtained so excellent a reputation amongst travellers. The schedule time of the specials, both up and down, was ninety minutes. But in point of fact, I think we saved about three minutes on each journey.

Arriving at Pakerston Quay we proceeded at once aboard the new vessel. She is a two-funnelled schooner, whose general appearance is somewhat similar to that of the vessels previously placed on the service. The remarkable point about her is, of course, the fact that she is the first vessel of the turbine-engined type to be put on the route between British and Dutch ports. Further, as was pointed out in one of the speeches made at the banquet after the inspection, she marks a new departure for her owners in the fact that she has been built by (to them a new firm of shipbuilders) Messrs. John Brown & Co., of Clydebank. Minute examination of the ship convinced one that she is the outcome of immense knowledge and unspared pains. The ability of the builders has been concentrated on providing a ship which shall in every way be fitted to the peculiar work of the Company which has ordered and is to run the steamer whilst they from the fullness of their experience in running steamships on the route have been able to supply many suggestions for the comfort and convenience of those who are to travel by the ship.

Though the *Copenhagen* is a vessel of 2570 tons gross register her designed draught does not exceed 14 ft. 6 in. her depth of hold being 18 ft. whilst her extreme length is 343 ft. and her beam 43 ft. Appliances for safety have the first place. The ship is divided into eight compartments by seven bulkheads whilst she carries some 1200 life belts and no less than eight boats. Of these latter which are carried on a boat deck, I noticed that some have steel and some have wooden hulls. Further some of the life buoys are of copper thereby attaining a degree of buoyancy considerably in excess of that afforded by the old cork made type. The boat deck affords excellent protection to the promenade deck. Every convenience is provided for travelling by night, and the ship is like an Atlantic liner on a small scale. Indeed in actual dimensions and tonnage it may be remarked that she exceeds many of the earlier and famous liners. The state rooms are fitted on quite the Atlantic plan and upwards of a hundred of them are designed for the accommodation of but two passengers. For the benefit of ladies travelling alone a whole block of state-rooms is set apart these adjoining a charming and spacious boudoir which like other public rooms of the ship is placed in communication with the ticket office by means of a speaking tube. The dining saloon is lofty and capable of seating some sixty passengers at a time for meals the service being from a pantry and bar both of which immediately adjoin it. Altogether it may be said 320 first-class passengers can be berthed in the ship. The smoke room on the upper deck is a singularly attractive room and one which I doubt not will keep many a traveller for a long while out of his state room. It is panelled in oak with seats of green leather and has the attraction of an open fireplace. Remembering that the North Sea has a reputation for coldness, the ship is well supplied with thermo-tanks, so that all parts of the accommodation can be kept at any desired temperature, even when the air outside is far below the freezing point. The second class accommodation at the after-end of the ship, though comparatively plain, is well designed and comfortable. Like the majority of Clydebank ships, the *Copenhagen* is fitted with the excellent steering gear of Messrs. Brown Brothers, actuated by a telemotor from the bridge. The main engines are of no less than 7000 I.H.P.—exceeding, by the way, those of the famous Guion greyhound *Arizona* in power. These consist of three turbines of the Parsons type, the centre turbine, which moves ahead, only being worked by high-pressure steam, whilst the two wing shafts use low-pressure steam and have reversing turbines attached. There are five single-ended boilers supplying steam under forced draught at 190 lbs. pressure. Electric light engines, pumps for various purposes, feed-water filters and other auxiliary machinery are present in plenty, and quite maintain the idea that one is aboard a model ocean liner. The speed of the vessel is stated to be 20 knots at sea.

After inspecting the ship, and having a glance at the new quay which the Railway Company is providing for the extension of the accommodation of the port, the guests were entertained at a luncheon which gave good evidence of the capabilities of the catering department at Liverpool Street. Here we were told that there is every likelihood that the satisfactory relations established between the railway company and the Clydebank firm will lead ere long to the provision of a sister to the present ship, whilst a certain amount of chaff as to the want of punctuality of continental trains was indulged in. A point was made by Lord Claud Hamilton which may well be recorded in this connection. It is this, and it applies as well to other cross-Channel services as to the Harwich route. Our English railways can comparatively easily keep their time. For the journey between the metropolis and the British seaport is short. But the Dutch, Belgian and French railways start under a disadvantage. Though their own mileage may be comparable with those of our own systems, they have to start their journeys with the accumulated delays of the German and Russian trains, and thus have to cope with the difficulties of a whole continent. To some of those present at the inspection it may have been somewhat of a disappointment not to have seen the *Copenhagen* under way. But the arrangements made for the guests' comfort were well thought out and excellently managed by Mr. C. Busk. The visit to the ship was compressed into a brief time and every opportunity for inspection afforded. An attempt to see her under steam would have involved a much longer day and would have put many of the guests to considerable inconvenience.

Dublin Corporation and the North-Western Fleet.

The Irish capital, not content with the sensationalism connected with the disappearance of the Crown jewels, has now gone in for some excitement with one of the principle customers of its port. Whilst the mail steamers of the City of Dublin Steam Packet Company, of course, use Kingstown as their terminus the numerous fleet of the London and North Western Railway Company make the North Wall at Dublin their head-quarters on the Irish side. On the 17th February two steamships of the Company, the *Scotia* and *Hibernia* both being large and fast vessels of the purely passenger side of the company's business, were seized at the instance of the Dublin Port and Dock Board for unpaid dues. On the following day a third vessel was treated in the same way. Needless to say, the Company promptly paid what was claimed under protest and restored the ships to its own possession. But of course, the matter will not now rest. Indeed, it seems likely to have a double effect, and under no circumstances to be calculated to benefit the prosperity of the Dublin Corporation. In the first place there will be a suit for damages by the Railway Company in respect of the detention of its vessels, and in the second they will carry out their intention of removing the passenger part of their fleet at least to the more friendly port of Kingstown.

The origin of the dispute appears to be this: There is a clause in the Dublin Port Act of 1869 which, in the case of "vessel carrying passengers only" permits the owners on payment in a lump sum in respect of such vessel of all charges payable under the Act for the number of six voyages, to

continue to use the port for a year from the date of such payment, free from all liability for further rates. Taking advantage of this provision, the Railway Company have made arrangements to carry nothing but passengers by the express steamers employed in their afternoon service from Holyhead, even parcels being sent by other conveyance. After six voyages had been made by the vessels respectively engaged in this service, a lump sum for the amount of rates chargeable in respect of them was, in accordance with the terms of the clause I have quoted, tendered to the Port Authority and declined. The ships, of course, went on using the port and at last were, as I have stated, seized, the Dublin people not accepting the view of the law which commends itself to the railway management. It may be remarked that it is strange that the North-Western Railway should only now be testing the provisions of an Act nearly forty years old. But there are several explanations for this fact. First, presumably, that it is only since great speeds have become fashionable that even their express steamers have reached the stage of carrying passengers only, whilst it may not have been worth their while to have raised the question till now when the Dock authorities are so strongly discriminating against vessels of the type which they use. Whatever may be the final result in the Courts, one thing seems to be certain, *viz.* that a good deal of custom will be diverted from the North Wall to Kingstown, and the driving away of custom is not generally accounted good business.

The American Mails

Post Office methods seem to be a little defective in regard to the arrangements for dealing with the ocean mails, if it be true, as stated in the *Times*, that a bag of registered letters sent out by the White Star liner *Celtic* on the 23rd January has failed to reach the New York postal authorities. The writer of the paragraph referring to this matter seems to think, judging from precedent, that the bag has merely gone astray. But the inconvenience and expense to which the public are put when important letters are delayed is considerable, and some care should be displayed in handling mail bags.

The Thames Steamboats

are no longer to run under the auspices of the London County Council. This decision was reached by a considerable majority of the councillors present at the meeting of the 18th February, though one fatuous member thought that it seemed very hard to discontinue a service which cost but £7,700 a year—or but a twentieth of a penny in the pound on the rateable value of London—and "gave pleasure to three millions of people." Without taking exception to all the fallacies in this utterance, it may be well to state that giving pleasure to three millions of people was just what the service did not do. Had it done so there might, even under municipal management, have been a profit on the working of the steamers. But as the passengers were reckoned by hundreds of thousands instead of by millions, the true loss was not £7,700, but nearer £40,000 a year. This being so there could be no justification for continuing an experiment which should never have been undertaken by such a body as the London County Council. The fleet is now in the market; but I should imagine that—the boats being of special design and construction—there will not be any great rush of purchasers to secure them.

Sir James Laing & Sons, Limited.

The unexpected failure of the large shipbuilding business of Sir James Laing & Sons, though coming as a shock to most people, can hardly have been a surprise to those who have followed recent events. The Company in its present limited form is about ten years old, and has a nominal capital of some £300,000. There are some £150,000 in three per cent. debentures. Besides the shipyard, the Company owns certain shares in shipping property. Two unfortunate matters must have affected the Company's financial position during recent months. First there was the fact that the firm was one of the syndicate which tendered for and obtained the Australian Mail Contract a couple of years ago. As my readers know, the contractors were, from causes quite beyond their control, unable to complete their engagement, and in the event the Commonwealth Government issued a notice asking for altogether fresh tenders, and has now placed the mails with the Orient Company again. A good deal of expense must have been occasioned to Messrs. Sir James Laing & Sons over this abortive business whilst, further, they had trouble over a shipbuilding contract with an Italian company for whom they had under construction certain high-class steamers. It appeared at the time that the purchasers were not content with the ships as tendered to them, alleging that they were not properly to specification, and they threw them back on the builders' hands. As it was stated that considerably over £200,000 was involved in this transaction it is obvious that there must have been severe stringency in regard to ready money, and shipbuilding firms, who employ so many hands and who spend so large a proportion of their outgoings on wages, are especially dependent on a good supply of ready cash for the continuance of their business.

The Orient Company.

I spoke a few lines back of the new mail contract made with the Orient Steam Navigation Company. To enable it to fulfil the terms of this undertaking the managers have now ordered some five vessels of 11,000 tons each. The building is distributed amongst four firms—three of which are on the Clyde. The firms in question are the Fairfield Shipbuilding Co., Messrs. John Brown & Co., of Clydebank, and the London and Glasgow Shipbuilding and Engineering Co. The fourth firm is Messrs. Workman, Clark & Co., of Belfast.

The Orient Company, by the way, is sending their name steamship *Orient* on a series of pleasure cruises during the earlier months of the current year, and has issued a most charming and well-illustrated handbook to the numerous places of interest in the Mediterranean Sea which will be visited in the course of the several trips which are being made.

The Egyptian Mail Company

has now the second of its steamships at work and they both seem to be giving every satisfaction to travellers. There are certain rumours to the effect that the Hamburg-American Steamship Company—which is paying so much attention to the development of its relations with Egypt generally—is likely to take a large interest in the Company, if not indeed actually to take a direct part in the direction of its affairs.

The Royal Commission on Shipping Rings

still drags its weary length along. It may almost be forgiven for its existence from the fact that it has extracted from that most marvellous man, Sir Donald Currie, one of the ablest letters which have ever been penned in relation to shipping matters. If those who attack the shipowners ever had any appearance of a case Sir Donald's exhaustive communication destroys their position at every point. He gives an interesting historical résumé of the South African steamship trade for the last half century and ends up with the statement that the Commission have now before them all the circumstances under which the mail contracts have from time to time been made and new steamship lines taken an interest in the South African trade. He sums up with the statement that from this it will be apparent that the present co-operation or conference of the shipowners has in large measure been brought about by the action of the merchants themselves and of the Chambers of Commerce and the South African authorities. Further, taking each of the points raised by those who would interfere with the shipowner's business and would strive to use force to bring him to their requirements, he is careful to show that there is no shadow of reason or justice in an attempt to introduce a policy of this nature into the regulation of such a business as that of the shipowner. Altogether his evidence is a masterly and exhaustive statement. The report that the Union Castle Line, in spite of the depression in South Africa, is ordering two new steamers for their trade shows the real appreciation in which Sir Donald holds the labours of the Commission. The new mail steamers' advent will send the *Carisbrook Castle* to reserve off Netley, and put the mails entirely in twin screw ships.

The New Cunarders.

The *Lusitania* and *Mauretania* are off their stations for some three weeks each, opportunity being taken to carry out certain small improvements and alterations which experience at sea has suggested. In the turbine engine vessels on which I have recently sailed there have certainly been traces of propeller vibration, though there is none whatever from the engines, and one of the points now being dealt with in these ships is the strengthening of the fabric in the neighbourhood of the outside screws, in order to remove as far as possible all indication of this annoyance.

THE USE OF LIME IN THE MODERN MARINE H.P. BOILER.

THE recent great developments which have taken place in the use of H.P. steam afloat, and the consequent increase in importance of the generator—requiring in its manufacture high tensile steel and the best design and workmanship—call for a more scientific and careful treatment of the modern marine boiler than is usually given.

The increase of pressure has greatly augmented the powers of the deleterious agents carried in by the feed water or produced in the boiler during working.

Acids such as oleic, also free air and the gaseous carbon dioxide and oxygen, are more readily generated or liberated under modern high-pressure conditions, and are increasingly more destructive than they were in the boilers in use ten or fifteen years ago. Taking into consideration the increased cost of the modern boiler in which the design, material and workmanship must be the best obtainable (especially in a boiler of the water-tube type) all the knowledge of the marine engineer (as well as any suitable appliances of modern science and invention) should be requisitioned in the difficult task of preserving and keeping in efficient working order the H.P. boilers entrusted to his care.

The use of an alkali as a preservative and preventative of deterioration in marine boilers has always been recognised, but only in recent years has the use of such progressed from the occasional and " guess-work " stage to that of a regular daily routine having a definite position in the care of all modern marine boiler batteries, where H.P. steam has made oil and air enemies to be dreaded.

Two alkalies stand out pre-eminently as " boiler medicines " afloat—in fact they are the only two which can be used—Lime (CaO) and soda (Na_2CO_3).

Soda is now seldom used for boiler work except in very minute quantities, as it causes priming, and injury to all joints not made of red lead—and even these are not immune if a soda solution is long in contact with them.

Soda also forms a soapy-like substance with any oil in the boiler, and as this mixture very often sticks more firmly to the shell than the original grease, the prevention, in this case, is worse than the disease.

Nevertheless soda is useful in a boiler which is being let out, previously to being cleaned, if it is mixed with lime and fed in cautiously, as will be described later on.

Lime is now recognised as the most efficient and trustworthy agent in preventing the inroads of the harmful lime salts found in sea water and some fresh shore waters, the acids liberated from the various oils that find their way into the boiler, and the free gases carried in by the feed water or evolved in the boiler.

The old method of using lime and soda by putting a solution in the feed tank has little to recommend it save its cheapness and ease.

In fact it is a decidedly harmful practice.

In the condenser soda especially only tends to clean out the oil and dirt, and these, as often as not, are conveyed to the one unfortunate boiler that is requiring at that moment—and getting, it is hoped, the most feed. Soda used in a condenser also frees lumps of oil and grease which cause the air pump valves to stick and so injure the vacuum.

Lime behaves better in the condenser as it finds its way to the feed tank without disturbing the deposits of grease.

But any large dose of lime or soda put directly into the condenser or feed tank—whilst useful as a cleaning agent for the feed tank or condenser—generally finds its way into the boiler that is feeding at the time, in far too strong a solution and tends to make that boiler prime, besides discolouring its [illegible].

The use of lime in marine boilers must be considered under two heads:

First, as a preservative of the surfaces of a boiler with which the water is in contact when standing full, partially full, or working.

Secondly, as the neutralizer of the injurious acids and gases which may find their way into the boiler through the feed or may be generated in the boiler where working.

(1) Lime as a preservative.

When a boiler is pumped up from empty to full, lime is [illegible] put in in sufficient quantities to at least saturate the filling water. This is usually done by placing a quantity of milk of lime in the boiler and then pumping up to about 20 to 50 lbs. pressure to expel all air. This method is not to be recommended, as the circulation in a cold boiler is practically nil, and consequently when the boiler is partially full the mixing of the water and lime decreases, the inrushing water being the only stirring agent; thus intimate mixing of the water and the lime can hardly take place and complete saturation of the water cannot be relied on as a certainty. This more especially applies to the top of the boiler (or upper drum, where saturation is most necessary, as all air and gases accumulate there. The better method is to have the lime regularly fed into the pumping-up water, as a much more intimate mixture of the lime and water takes place in the feed pipe and pump, and the whole mass of the water contained in the boiler is properly saturated.

The quantity of lime required to saturate water varies with the temperature of the water—the quantity decreasing as the temperature increases.

Three pounds of lime is required per ton of distilled water, when the temperature is 60° to 70°F., and one and a half pounds when the temperature has risen to 212°F.

A boiler which is to stand for any length of time requires at least three pounds of lime per ton of contained water—if distilled; more than this is not required, as the surplus settles to the bottom and may choke or injure the faces of the running-down valves.

Half an ounce of caustic soda ($NaHO$) per ton of water is used by some marine engineers, as it is believed to assist the water to absorb the lime and prevent any salts of lime forming a hard deposit on the shell or tubes. It certainly assists in rendering the water alkaline and can do no harm.

Boilers that are pumped up to working height and which will shortly be in action, do not require more than one and a half pounds of lime per ton of water and about a quarter of an ounce of caustic soda per ton of water if fancied.

These quantities of lime are simply preservative and are not intended to kill the acids and gases introduced by the feed water. These must be dealt with separately and in another manner.

(2) Lime as a preventative.

Lime as a preventative neutralizes the oil and fatty matter in the feed water and assists to render innoxious the oxygen and CO_2 held in suspension in the feed and make-up feed water.

The dangerous oils and gases which, when introduced into the boiler, do so much damage, are always found in the feed water in very minute particles; the oil, as a rule, in the ordinary feed water, coming from the condenser, the air and gases in the make-up feed. Air is very often introduced by the ordinary feed having a fall from the air pump discharge before it reaches the feed tank level, as shewn in Fig. 1.

Lime and oil have a mechanical affinity and mix easily even when large quantities of water are present; so that if sufficient lime in solution be introduced into each ton of feed water, as it flows on its way to the feed pump, it is intimately mixed with the oil-laden water before reaching the boilers and combines with the oily particles. When the particles of lime and oil " mix " the alkaline properties of the lime so neutralize the acid forming tendencies of the oil that even when the combined particles of oil and lime which miss being caught in the filter find their way into the boiler no dangerous acid is formed from the neutralized oil-laden particles.

Practically the same process takes place with CO_2 and O when free in the feed or make up feed water, only the more powerful chemical affinity in this case directs the movements of these particles.

Lime to be of use as an oil killer must be fed in very regularly, very constantly and in very small quantities to the feed water. An ideal feed is a constant stream of chemically pure lime water discharging into the feed water and mixing with it on its way to the filter or feed pump.

At present there are two mixers or tanks for this purpose. One is a tank using hydraulic pressure as the mixing agent and the other is a tank using steam for the same purpose. The first, which is illustrated in Fig. 2, consists of a large built-up tank of three-sixteenths of an inch plate and varies from three to six feet in length, and from two to four feet in diameter and is so placed that its top is above the level of the feed tank overflow.

A manhole is provided in the top plate and is used for cleaning and lime-charging purposes.

A pipe is led from the discharge side of the feed pumps into the top of this tank.

In large installations a separate system of piping is led round the stokeholds, having a connection to each feed-pump discharge.

The discharged water from this pipe is directed towards the bottom of the tank, where it stirs up the lime. On one side near the top a tap is placed discharging into a funnel. This funnel is attached to a pipe which leads the mixture of lime and water to the feed tank, where the lime and feed water are mixed before proceeding to the feed pumps.

This is an extremely simple type of mixer, but, whereas it is a great improvement on the old method of putting the lime direct into the feed tank, it also has many disadvantages. (1) Power is lost, as the feed-pump pressure is utilized for mixing purposes, (2) the pressure of the feed-pump discharge rises as the boiler feed is checked, causing the mixing to be strongest when the feed required by the boiler is least, resulting in the greatest quantity of lime being given to the feed when the feed water is flowing most slowly and *vice versa*, the result being great irregularity in the lime feed.

(3) The discharged water falling into a funnel is slightly aerated thereby carrying air into the feed water.

(4) A long system of piping and several valves are required in a big ship or where several feed pumps are used.

(5) The bulkheads require to be pierced.

(6) The tank is large for its work, and consequently occupies a considerable amount of valuable space.

(7) The amount of lime feed is not easy to control.

(8) The weight of the mixer, when full, is considerable.

The other type—the steam mixer, which is illustrated in Fig. 2—is much smaller in size and consists of a cast-iron cylinder 2 feet in length and 6 inches in internal diameter, three-eighths of an inch in thickness, tapering at the bottom to a point, thus forming a cone.

This type of mixer has all the best features of the old pattern tank. It also acts as a feed heater, and helps to eliminate any free air or gases in the inflowing water, or which are freed in the mixing of the lime and water.

Lime (as a milk) is filled in through a pipe led well above the level of the feed tank overflow. A bib cock is screwed in near the top of this pipe, also a plug to prevent dirt getting into the interior of the mixer.

The lime when poured into the filling pipe sinks to the bottom of the tank and forms a silt around the inner cone. When the steam and water is turned on at the injector, the inflowing stream of hot water is forced through this silt. The water and lime are thoroughly mixed in the space provided below the bell-shaped baffle, about two-thirds of the way up the tank, all the gases and air expelled from the incoming water by its increased temperature, are caught by the bell baffle and find their way up the filling pipe and out by the small bib cock at the top, provided for that purpose.

The lime water has to find its way past the edge of the bell baffle and then through the gauze wire screen. This baffle and screen break the direct flow of the water, and give all the larger particles of lime an opportunity to settle and dissolve. The lime water then proceeds through a large gauge glass mounting to a pipe, leading to the filter or feed pump. A cock and funnel is, in some cases, fitted in lieu of the gauge mounting, but if simpler, is not so good, as the falling water tends to get slightly aerated, which is not to the advantage of the boilers.

The steam for injection can be led from any drain cock in the engine-room. The steam used is in no way lost, as it is employed in heating the feed water.

It is recommended that the injector have two leads, one from the feed tank, the other from the reserve tank, so that all make-up feed may be taken through the lime tank, thereby partially freeing it from air and CO_2 and at the same time raising it in temperature before it proceeds to the feed pumps.

In a large ship, even when running at high power, all make-up feed water could be passed through this tank by means of the injector. This alone would lead to a considerable saving of fuel, in addition to prolonging the life of the boilers, as one of the chief causes of pitting in boilers is now admitted to be the free air carried in by the make-up feed water.

This tank is very compact and light, and is extremely regular in its lime feed when properly set.

It is very adjustable, and can be set to feed with regularity from two lbs. to two cwts. of lime per twenty-four hours.

No lengths of piping or numerous valves are required in the stokeholds and no piercing of the bulkhead is necessary with this type of mixer. It is also easily cleaned and filled and has no parts to get out of order.

The gauge glass, through which the feed is discharged, allows the process to be watched and adjusted without aerating the lime water, as in a cock and funnel discharge; a bib cock is provided on the gauge mounting for testing purposes.

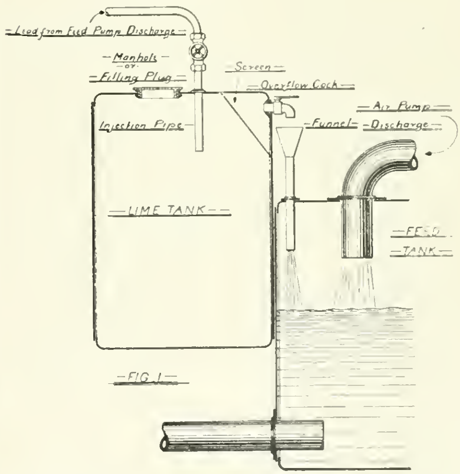
No matter what type of mixer is used the chief things required in a mixer are:—

(1) Regularity of feed.

(2) Ease of adjustment.

If a known quantity of lime can be regularly mixed with the feed water, each boiler then takes in a quantity of lime directly proportional to its feed and as a consequence the impurities of that feed.

As the mixture of the lime and feed water takes place (or should take place) before the filter is reached, the particles of lime have an opportunity of assisting the filtering material to seize and retain the oil carried by the feed water.



The mechanical mixing of oil and lime also goes on inside the boiler, but is much less effective, as the dangerous acids are generated from the oil very shortly after it has reached the high temperature of the boiler water.

The same applies to the air and gases in the feed water. Both oil and gases, if possible must be killed before reaching the boiler.

When the oil and lime particles in combination reach the boiler their dangerous properties of oil have apparently been killed by the union with the lime.

The condition of the interior of the boiler, when opened out, is a good check on how the lime feed has been regulated. If the oil has been in excess, a clayey oily deposit will be found on the shell and tubes of the boiler least exposed to the fire. If, on the other hand, the lime feed has been in excess a heavy deposit of lime will be found on the shell and tubes. But if the proportions have been rightly adjusted, the lime and oil will deposit as a dry clayey mass along the water line and surfaces of the boiler which first cool. The rest of the shell and tubes, in contact with the lime-charged water, will have a very light deposit of lime, almost as if they had been frosted or powdered with it.

These deposits of dirt [illegible] an lime are easily removed and will [illegible] almost forming a striking contrast to the difficulty encountered in removing the grease and dirt from the shell and tubes of a boiler which has not been treated with a lime-saturated feed.

A lime-feed is especially necessary. The feed must be constant, regular and in very small quantities. Lime put in the boiler before closing up has in no way the same effect and only slightly prevents the deposit of oil and grease and the generation of dangerous acids. It also to a much greater extent chokes and discolours the gauge glasses.

Lime before closing up is only useful as a preservative to the shell of the boiler by rendering the water alkaline. With regard to the use of lime in the feed the important question arises as to what quantities should be used.

There are several ways of measuring the quantities required:—

(1) By H.P. developed.

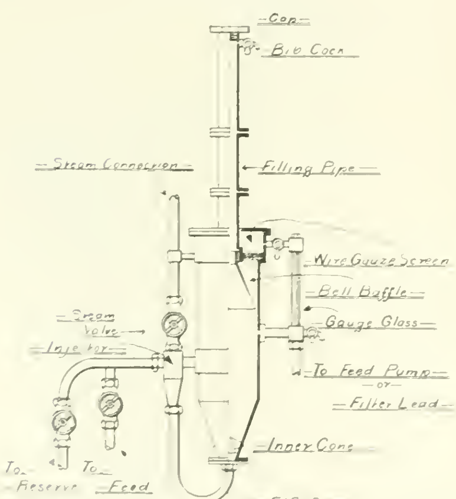
(2) By the number of tons of feed water used per twenty-four hours.

(3) By the alkalinity test.

(4) By the number of square feet of internal boiler surface.

(5) By the number of tons of water in the boiler at working height and when full.

— Steam Mixer —



— FIG. 2. —

[illegible] alkalinity test [illegible] the boilers and [illegible] of blowing [illegible] and [illegible] on using lime.

The number of tons of water [illegible] the [illegible] for the quantities of lime to be used when [illegible] [illegible] [illegible] [illegible] [illegible] per ton of [illegible] of the boiler [illegible] [illegible].

[illegible]

[illegible] number of tons of water evaporated per twenty-four [illegible]

[illegible] the boilers are working [illegible] the [illegible] amount of oil supplied by the auxiliary machinery is so distributed over the increased number of boilers as to be practically negligible. The increased efficiency of the steam when on the main engines and consequently the less coal burnt per ton of water evaporated must also be considered in this matter. So that in practice only two proportions of lime per ton of coal burnt may be considered:—

(1) For boilers on auxiliary work only.

(2) For boilers on main and auxiliary work combined.

Under modern conditions of marine engineering the amount of oil in emulsion per ton of feed water is very small and the amount of lime required is small in proportion, but to be effective must be fed in very regularly and in very small quantities.

The following rules are based on the assumption that one ton of coal evaporates 10 tons of water.

Boilers on auxiliary work only require about 3 ounces of lime per ton of coal burnt to kill the oil in emulsion and neutralize as far as possible all free gases.

Boilers working on main and auxiliary machinery combined require $1\frac{1}{2}$ to 2 ounces of lime per ton of coal burnt.

These quantities assume that the boilers are already charged to at least $1\frac{1}{2}$ lbs. of lime per ton of contained water.

In either case reduce the lime to 1 ounce per ton of coal when the boiler gives a very sharp reaction to the litmus test.

Scum about one to two inches in the gauge glass and blow out another one inch when the boilers have received $1\frac{1}{2}$ to 2 lbs. of lime per ton of contained water through the feed. The scumming and blowing out should only be done when the boilers are working easily.

If carefully applied these rules should keep the boilers in good condition.

When W.T. boilers are being forced, the lime feed should be eased or altogether ceased to prevent the boilers priming.

Always give the boilers a good scumming and blowing out when finishing with the main engines and fires are dying out. This is best done when steam has fallen to between 50 and 20 lbs. pressure.

A boiler which is shortly to be cleaned and is working easily may receive a special "finishing" or cleaning mixture made of one part soda to two parts lime. Eight ounces of this mixture per ton of water in the boiler is sufficient. It should be fed in gradually at the rate of not more than one pound per hour. As a boiler in this condition will not stand any forcing this mixture should be the last thing it receives before the fires are dying out, and it should be well scummed when pressure has fallen to 30—50 lbs. The water should be run into the bilge as soon as possible after the boiler is cold and the boiler thoroughly cleaned before again using.

As regards small tube boilers special attention must be paid to the lime feed.

Lime, in excess, may easily cause priming in small tube boilers, especially in some classes of them. This necessitates very careful adjustment of the lime mixer. These boilers when subject to forcing should not have more than 1 oz. of lime fed in regularly and well diluted, per ton of coal. It should not be put into the mixer in too great bulk. The mixer should be changed at least once every eight hours or every four hours if too much labour is not involved.

A small tube, in fact any W.T. boiler may prime on lime being first introduced into the feed water. This as a rule only occurs when the lime is put into the feed in too great a quantity at a time. A boiler often primes on the slightest change of density in its feed. But after a short time it gets used to the slight increase and the priming ceases. The feed may then be maintained at the increased density without any further protest on the part of the boiler.

Lime in the feed—especially in excess—is liable to produce discoloration of the gauge glasses.

It will not be amiss here to give the method usually used to clean a discoloured glass, also to hint that it may be practically overcome by a regular and constant lime feed [illegible] at the [illegible].

When discoloration has taken place, boiling out the discoloured glass with vinegar or a weak solution of some [illegible] such as muriatic acid (spirits of salt) will remedy this. The procedure is to close the steam and water cocks and then [illegible] the glass and close the drain cock. The top plug is then removed and the glass is cautiously three parts filled with vinegar or a weak acid solution. The plug should then be replaced and the water cock cautiously opened, followed

shortly after by the steam cock. Allow the solution to boil for a few minutes, then drain and blow through in the ordinary manner. This should leave the glass clear. It is important that this should only be done by an experienced and careful person as the work involves the risk of a severe scalding.

Litmus is the recognised test for alkalinity.

A well-fed boiler should always give a sharp reaction to litmus, but when a sharp clear blue is immediately obtained, ease the lime feed to one oz. per ton of coal, or even less, as additional lime will only cause the glasses to discolour.

Experience with litmus will enable an engineer to judge exactly how his boilers are working, and so to regulate the lime feed as to assure the good condition of the boiler shell and tubes, and facilitate the cleaning of the boilers when opened out.

A much more delicate test for alkalinity is phenolphthaline and, where available, it will be found very useful as an alkalinity test for the feed water.

Water, drawn from the feed pump, should give a delicate red ring to a drop of phenolphthaline, but should in no way affect litmus paper.

This is an almost ideal condition of the feed water, and should in practice be obtained—if the lime mixer is working properly.

It is also well to recollect that lime and soda have distinct reactions with silver nitrate ($AgNO_3$) and tend to confuse a casual observer testing for salt (NA.CL.).

Soda gives a dark brown precipitate with $AgNO_3$, lime a light brown, salt a dead white. Thus lime or soda may not only be confused with, but may even conceal the presence of salt.

Lime also gives a rise of density in the hydrometer test varying from ·007 to ·008 at 200°F. per pound of lime in each ton of distilled boiling water. This is taking the density of sea water as 10.

In conclusion, a moderate use of lime, with the aid of a good lime mixer, can be relied upon to save a marine engineer in charge of a battery of boilers, whether W.T. or Scotch, an endless amount of worry and trouble with regard to their cleaning, pitting and general working conditions.

REVIEWS.

The Mechanical World Electrical Pocket Book for 1908.

THIS is a companion to the one noticed on p. 350, and issued from same office. It is, as may be assumed, on same lines as the other, and opens with units, types of dynamos and motors, and notes on their care and management and defects. The test of simple circuits is important, while measuring instruments are fully noticed. Accumulation lamps and lighting are all found with cranes and pump, which finish, as it seems to us, the purely electrical portion, the remainder being taken up with mensuration and tables of general principles. What there is here is of the right quality, but there is scarcely sufficient to be able to say the whole subject is dealt with in a complete and effective manner.

Les Flottes de Combat. En 1908 (5 fr.). Paris: Berger Levrault Cie.

IN the preface the author notes the fact that men-of-war are limited only by the power of purchasing them, and he considers turbines not to have done as well as expected of them, and gives the limit of 20 knots for large ships and 33 for small ones. Beginning with Germany, we have elevation and plan of the men-of-war of each country by classes with description and power of defence and attack. As to Great Britain, the French seem to be possessed of full and complete information as to our ships, judging from what we find here. Considerable interest attaches, perhaps, to what is given of French ships, but there is the same publicity, and it is possible to compare very closely with other countries, there being every opportunity given and absolutely no difference in the information. Japan, too, has an interest as including the Russian ships captured by her and found here. Important, too, is the fact that at the end there is an index of all ships of whatever country given alphabetically and stating the page at which particulars are to be found.

Schiffsjungendienst. Von. Kapitan G. Rienicke. Berlin: K. W. Mecklenburg. 1907.

THIS is the second of the series from a practical man's point of view. Beginning with a general description the author follows on with daily routine, watch-keeping, spars and sails in their various forms, till we find ourselves supposed to be actually at sea. The loading is described, followed by voyages in different oceans and home waters. The rules for the size and arrangement of crew's space on board are then given in detail, with an index at the end. This is in a great measure in colloquial form. It will be seen, therefore that the practical man's point of view is found here told.

Transactions of the Institution of Engineers and Shipbuilders in Scotland. Vol. L. Edited by the Secretary.

As a record of the proceedings of this well-known Institution in its year of jubilee the present volume gives ample evidence of the vitality of this professional body and the comprehensiveness of its interests and operations. In weight avoirdupois, the volume forms, if not a record, at least as substantial a contribution to the archives of the Institution as has yet been made. Some 516 pages make up three-fourths of the volume's thickness, the remaining fourth consisting of folding plates of illustations. The address of the president, Mr. James Gilchrist, which is of less than the average length, touches upon the outstanding features of the Institution's work, and the main questions before the engineering and shipbuilding world. It is followed by a very elaborate paper on "The development and present status of the steam turbine in land and marine work," by Mr. E. M. Speakman, who projects his survey into the future so far as to take cognisance of gas turbines and their problematical success in practical work. "Wide experience of the steam turbines," the author concludes, "enables one to foresee innumerable difficulties in the way of gas turbines, but fortunately a difficulty anticipated is of material assistance towards its solution." The discussion on this paper is strongest in the direction of the application of the steam turbine to marine purposes, and a number of well-known members contribute informative remarks. Following Mr. Speakman's paper is an even longer one on "Suction gas engines and gas plant," by Mr. Hugh Campbell, of the well-known Campbell gas engine firm, of Halifax. This paper elicited even a longer and livelier discussion than the previous one, the subject of the application of gas engines to marine purposes again forming a prominent portion of the discussion. "The stability of submarines" is a paper by Mr. J. G. Johnstone, B.Sc., which perhaps naturally only few members felt competetent or disposed to criticise, the discussion on it being brief. This is followed by a lengthy and highly suggestive paper by Mr. Wilfred L. Spence on "The mechanism of power transmission from electric motors." Rich in points of practical moment, this paper was briskly discussed and its value added to by the members. "The most economical mean effective pressure for steam turbines" is the title of a paper by Mr. R. Royds, M.Sc., which elicited an interesting and valuable discussion. In the present volume, for the first time, we think, two papers are included which were read in the Students' Section, these being well worthy of the distinction. The papers are "Tramway and railway electric traction," by Mr. George G. Braid, and "Some details of Albion motor cars," by Mr. T. Blackwood Murray, B.Sc. In addition to the usual minutes of proceedings and reports, some pages are devoted to an account of the "James Watt" anniversary dinner. The laying of the memorial stone of the Institution's new buildings, etc., and there is an exceptionally heavy number of obituary notices of deceased members, a fact which will be better understood when we say that the subjects of these include such men as Mr. Walter Brock, of Denny & Co., Dumbarton Mr. Andrew Brown, of Messrs. William Simons & Co., Renfrew; Sir William Robert Robertson Copland, LL.D., Ernest George Gearing, formerly of the Inman and International Steamship Company; Mr Henry M. Rait, of Messrs. Rait & Gardner, London; Mr. Hazelton Robson Robson, and Mr. James Rowan, of the firm of David Rowan and Son, Glasgow. The list of members, associates, etc., followed by a complete index to the reading matter and the folding plates of illustrations are the other features which make up this valuable record of the Institution's doings and progress. The whole reflects credit on Mr. Edward H Parker, the energetic secretary of the Institution.

NAVAL MATTERS PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

THE *St. Vincent* is progressing steadily, although to look at her one would not perhaps think so. Her sides are rather low, this being done so that more of the inside work may be got on with, such as the fitting of the fore and aft bulkheads and the lower athwartship bulkheads. The seaward end of the building slip, a portion of which was damaged at the launch of the *Bellerophon*, is being strengthened and repaired, but this does not interfere with the building operations of the *St. Vincent*. The *Bellerophon* is making good headway, all her eight turbines having been put on board. The battleship *Vengeance*, which has been engaged in fire-control trials, returned from Torquay to have some defects in her turret roller paths put right, and this having been done she left at the end of January to rejoin the Channel Fleet at Portland. The flagship of that fleet, the battleship *King Edward VII.*, is now out of hand. She did a good coaling performance on February 7th, having taken on board from a collier 1,180 tons in four hours five minutes—an average of 288·9 tons per hour. Her previous best was 285 tons per hour. Another battleship, the *Goliath*, has completed her refit, and on February 19th left for the Mediterranean to take the place of the *Irresistible*. The Royal yacht *Victoria and Albert* has practically completed her refit, but there are a few final touches to be given to her. Another vessel, the cruiser *Pandora*, is being prepared to relieve her sister vessel, the *Pelorus* on the Cape of Good Hope station. The specially constructed lighter, which was built by Messrs. Day, Summers & Co., at Southampton for the purpose of laying concrete blocks across the Horse Sand shallows, is being fitted with further appliances, including a pile driver, which has been erected on the stern. A large number of the blocks have been made at Stokes Bay under the supervision of our Works Department. The destroyer *Quail* appears to be an unfortunate vessel. After having been extensively repaired as the result of damage sustained in a collision a few months ago, she was leaving the harbour for a trial trip towards the end of January and ran foul of the torpedo gunboat *Hazard*, which was lying at a buoy. The *Hazard's* cable was carried away, and as she began to drift a tug was sent to her assistance. The *Quail* returned reporting a leak, and this necessitated her again being docked. She has now been put right and on February 14th proceeded to Sheerness to rejoin her flotilla. On February 4th there was a collision between the destroyer *Zephyr* and Torpedo Boat No. 2 in the harbour, the stem of the former striking the port quarter of the torpedo boat and making a large hole in her, through which the water poured, the after part of the vessel being flooded. A collision mat was got over the side and the boat was subsequently docked. The *Zephyr* sustained a slight injury to her stem, and had to be relieved from duty with the Gunnery Establishment. On February 17th another mishap occurred in the harbour, the destroyer *Lightning*—also a tender to the Gunnery Establishment—colliding with a mooring buoy with such force that she was badly damaged on her starboard bow and made water fast. She is now in dock and another vessel has been told off to perform her duties. The wooden line-of-battleship *Asia*, the old Royal yacht *Osborne*, the brig *Seaflower* and the coastguard cruiser *Lily* have been placed on the sale list. Two battleships, the *Thunderer* and *Devastation*, have also been removed from the effective list and will soon share the same fate. They are sister vessels of 9,330 tons, and were launched respectively in 1871 and 1872. The *Flying Fish*, of the Channel Fleet Destroyer Flotilla came in on January 31st to be docked. The flotilla has now six vessels with nucleus crews to take the place of disabled craft. Three of the six vessels have gone to Portland from this port. The petrol carrying vessel *Isla* arrived from Sheerness on February 6th and has been attached to the *Mercury*, the depot ship for submarines. A test mobilization of the vessels of the Home Fleet was made on January 31st and was very satisfactorily carried out, the ships completed to full crews being fifteen battleships and cruisers, four torpedo gunboats and twenty-nine destroyers and torpedo boats. The battleship *Prince George* (the flagship of Rear-Admiral Farquhar) and six cruisers of the Home Fleet left for a three weeks' cruise on February 10th. The cruise should have commenced a week earlier, but it was postponed in consequence of the death of the Rear-Admiral's father, Admiral Sir Arthur Farquhar, a veteran of ninety-two years of age, the oldest officer, I believe, in the Navy. There has been a long delay in commencing the new lock, practically nothing having yet been done. It was confidently expected that a start would have been made in April, but it does not appear as if anything will be done until the summer comes. We have had a visit from Mr. Marshall, the Director of Dockyards. On February 17th he had quite a lengthy consultation with the Admiral Superintendent and the heads of departments as to the refits for the next financial year.

Chatham Dockyard.

During the last week of January one hundred casual labourers were entered for the purpose of cleaning up the cruiser *Shannon* and assisting in getting her ready for commissioning. The work should be completed by the end of February, and the vessel will shortly afterwards take her place in the Home Fleet at the Nore. Alderman Jenkins, our Member of Parliament, was one of the deputation from the Trades Union Congress which waited on the Admiralty on January 30th. At the dinner of the Medway Traders' Association on February 5th he referred to the improved condition of the yard, and said that he would rather see it grow gradually than by leaps and bounds. He hoped the Admiralty would recognise the fact that they had a naval base at Chatham which was capable of being used to a much greater extent than it had been. The position had been placed before my Lords, and when he was at the Admiralty with the deputation he was assured by the First Lord that Chatham was well provided for in the coming year. He (the Alderman) had complained in the House about the Government not improving the dock accommodation, and he expressed the opinion that at each naval base there should be now a dry dock large enough for a *Dreadnought*. The *Dreadnought* was now at the Nore, and where could she be docked if she were damaged? While they were getting her round to a suitable port she might sink, and then two millions of the nation's money would be lost. There is one thing certain, it will not be our member's fault if Chatham is neglected by the powers that be. The battleship *Ocean* is daily expected for a refit. When completed, she is to go out to the Mediterranean, her place in the Channel Fleet having been taken by the *Irresistible* from the former fleet. The idea of the interchange of vessels is, I believe to make the Mediterranean Fleet eventually a homogeneous fleet of vessels of the *Canopus* class, in the same manner as the Atlantic Fleet is a homogeneous fleet of *Duncans*. The *Bacchante*, the flagship of the Third Cruiser Squadron in the Mediterranean, arrived on February 14th and has been recommissioned. She leaves almost immediately for Malta with ratings for the depot ship *Orion*. The battleship *Majestic*, having completed her refit, left to rejoin the Home Fleet at Sheerness on February 19th. Two days later the *Vindictive* came in for refit. The *Cochrane* and the *Leviathan* (the flagship) of the Fifth Cruiser Squadron are in hand refitting. The *Warrior*, also of that squadron, came in on February 5th for some alterations to her armament fittings. As to small craft, Submarines C 2 and C 5 have had a thorough overhaul and are now in the steam basin, where their refit is being completed. Torpedo boat No. 112 has completed her refit and rejoined the flotilla. It has been decided that the two old battleships of the *Admiral* class, the *Camperdown* and *Rodney* are of no further use and they are therefore to be "scrapped." They are vessels of 10,000 tons and were launched about twenty-three years ago. Before long they will be taken round to the River Stour or to the Blackwater, where several other non-effectives are laid up. We had a visit at the end of January from the Director of Naval Education, Professor Ewing, who distributed the prizes to the boy artificers on board the training establishment, the *Tenedos*, originally the *Triumph*. The Professor lunched with Captain Smith and the officers and afterwards paid a visit to the workshops, lecture rooms, etc., of the establishment, expressing himself perfectly satisfied with his inspection. An interesting exhibition of the work of our military friends the Royal Engineers was held at the Electrical School on January 30th and 31st. The general opinion was that the exhibition, which consisted

of about 120 paintings, mostly water-colours, the work of the members of the Sketch Club, was a most excellent one. There were a large number of visitors on the two days, including Major-General Scott.

Sheerness Dockyard.

We have had several mishaps to small craft recently. While going up to Chatham about the end of January the tug *Asp* came into collision with the ram of the battleship *Edinburgh*, which is moored in Kethole Reach. The tug sustained a rent in her port side, through which the water flowed into her engine-room, and it was deemed advisable to run her ashore. The tide was flowing in, and in a few hours only her funnel and bridge were above water. Her salvage was smartly effected. The *Clinker* was sent with workmen to execute temporary repairs, and within twelve hours the craft was floated and shortly afterwards she was berthed in No. 3 Dock. The operations were carried out under the direction of Lieutenant Munro, assisted by Mr. Road, the foreman of the yard and Mr. Harcombe inspector of riggers. The *Edinburgh*, it may be mentioned, which has been moored in the Medway for the past three years, has now been removed from the effective list. She was launched twenty-five years ago, and was last employed as tender to the Gunnery School. That establishment, it has now been definitely announced, is to be transferred to the Royal Naval Barracks at Chatham, on June 30th. On February 1st the torpedo gunboat *Spey* was damaged alongside the dockyard wall and had to be taken into the steam basin. A week later the torpedo gunboat *Leda*, which had been attending to the moorings of the obsolete vessels in Harwich harbour, came into collision with the old cruiser *Andromache*. A large hole was made in the side of the *Leda*, and as she began to heel over she was run ashore and beached. The scout *Pathfinder* happened to be at Harwich with the destroyer flotilla, which was on an exercise cruise. Subsequently the *Leda* proceeded to Sheerness under her own steam, accompanied by the scout, and was taken into the steam basin for repair. The last mishap was on February 14th, when torpedo boats Nos. 112 and 073 came in for the repair of damage sustained by colliding with each other. The former boat suffered the most, and water was still making its way into the bunkers through a hole in the port side when she arrived. The battleship *Dreadnought* arrived on February 4th from Portsmouth, and has taken over the duties of flagship from the *Victorious*. No. 21 moorings, which are in close proximity to the Commander-in-Chief's official residence, were not ready for her, and she was berthed for a fortnight at No. 8 buoy. As if in honour of the arrival of the flagship, Vice-Admiral Sir Francis Bridgeman gave a ball at the Gunnery School the same evening. It was a most brilliant affair, over three hundred guests being present. The *Afridi*, one of the new ocean-going destroyers, is in No. 5 dock preparing for her official trials. A sister vessel, the *Cossack*, arrived from the contractors on February 14th to be commissioned for service in the Permanent Flotilla. All the vessels of this class are to join that flotilla. The destroyers *Nith*, *Ness*, *Swale*, *Ure*, *Erne*, *Wear* and *Ettrick* of the Permanent Flotilla, which are undergoing a refit, are to have their armament strengthened by the mounting of three 12-pounder quick-firing guns in place of their five 6-pounders. The torpedo gunboat *Jason* of the Home Fleet Flotilla has completed her refit. A test mobilization of the nucleus crew vessels of the Home Fleet was carried out on February 7th. The order to mobilize was given at the Gunnery School at 7.15 a.m., and in five minutes the first division had paraded and the men were marching to the landing stairs to be conveyed to their ships. The performance was most successfully and expeditiously carried out. Rear-Admiral Casement, the Admiral Superintendent, as I said would most likely be the case, does not leave us consequent on his promotion to flag rank just yet. He will remain until July 1st, by which time he will have been here fourteen months.

Devonport Dockyard.

The building of our new battleship, the *Collingwood*, was begun on Monday, February 3rd, when the first keel plate was laid in the presence of about fifty of the principal officials of the port and dockyard, including Admiral Sir Lewis Beaumont, the Commander-in-Chief; Vice-Admiral Barlow, the superintendent of the yard; Commodore Brock, of the Royal Naval Barracks, and Mr. Richards, the constructive manager. Mrs. Brock performed the ceremony by turning a switch which started a small motor, this moving the keel-plate into position. This lady also drove the first rivet, succeeding rivets being driven by other ladies. The ceremony was notable inasmuch as it was the last important function here in which the three first-named officers will take part. Admirals Beaumont and Barlow both relinquish their positions in March, and the same month, Commodore Brock will be promoted to flag rank, which will, of course, necessitate his giving up his post. It is expected that the ship will be launched about September; indeed, there seems to be no reason why she should not be. Hundreds of tons of material are on and around the slip, and excellent progress is being made with the construction of the vessel. I may here mention that the Admiralty have increased the vote for material for the current financial year by £10,000. The progress during the first week was very satisfactory, over 700 tons having been worked into the hull by noon on Saturday. Our other vessel, the *Téméraire*, is making good progress, the wing propellers and rudders being now in position. The cruiser *Minotaur* is now carrying out her trials. The latest orders are that she is to be complete and ready to join the Second Cruiser Squadron by March 31st. She will thus have taken three years and three months to complete, her keel plate having been laid on January 2nd, 1905. The cruiser *Argyll*, which was re-commissioned on February 4th for further service in the First Cruiser Squadron, has been installed with the improved wireless apparatus known as "C tune," a type which is being subjected to exhaustive trials. With this apparatus it has been found possible to maintain communication at distances exceeding five hundred miles. The battleship *Hibernia*, the flagship of Vice-Admiral Sir Reginald Custance, second in command of the Channel Fleet, has arrived in harbour for her annual refit. She will during her stay be fitted with submarine signalling apparatus. The cruiser *Talbot* will also come in for her refit at the end of the first week in March. The gunboat *Ringdove*, which has been employed on fishery duties on the coast of Scotland, arrived for a refit on February 7th. A test mobilization of the Home Fleet was carried out on January 25th, no fewer than two thousand men being embarked on the various ships to bring the complements up to full strength. The work commenced at seven in the morning, and the men having been told off to their allotted stations, the order was given to demobilize. By ten the usual routine was resumed in every ship. The first practice cruise of the division since Rear-Admiral Denison assumed command commenced on February 4th, and lasted until the 14th, Torbay being used as a base. The vessels which took part were the battleships *Mars* and *Hannibal* and the cruisers *Niobe* (the flagship), *Donegal* and *Doris*. Three twenty-four year-old battleships, the *Anson*, *Howe* and *Benbow*, have been placed on the non-effective list. They have not been in commission for some time, and they will probably be included in the next sale at this port, which takes place in October. Two members of a Harbour Commission appointed by the Government of Canada to visit the principal ports of Europe paid a visit to Devonport the last week in January, accompanied by Mr. Warbrick, of Sir John Jackson's, and inspected the Extension Works. The Commission is to prepare a scheme for the extension of the dock and wharf accommodation of Montreal. Mr. Sesterton, an engineer, has also been on a visit to the port. He has a plan for an improved naval boiler with interchangeable parts, which, it is said, will do away with the necessity of effecting repairs on board. The boiler is stated to have received favourable attention from several well-known naval engineers.

Pembroke Dockyard.

Very satisfactory progress is being made with the *Defence*. Although it has not yet been settled when the main propelling engines are to be moved, it appears certain that this and every other preliminary test will be carried out by the end of March. The ordnance steamer *Flamer* arrived at the end of January from Woolwich with six 7·5-inch guns. Two of the guns having been placed in the gun-houses on the port side, the vessel was turned round on January 30th and two shipped on the starboard side. The vessel has now on board her four 9·2-inch guns and six of her ten 7·5-inch. The other guns are expected before the end of February, as are also the gun-houses. Twelve of the sixteen 12-pounder (18 cwt.) guns have also been delivered. As to the *Boadicea*,

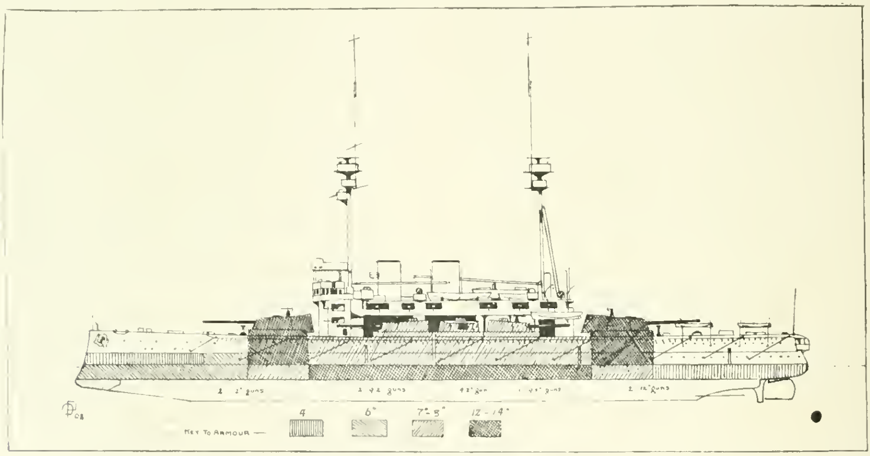
preparations for her launch are well in hand. The work on the hull is being pushed forward, and it was anticipated that it would be sufficiently advanced to permit Messrs. John Brown & Co.'s men commencing to bore out for the four propellers during February. That, however, was not possible. The outside plating will not probably be all in place and riveted until the end of February, and this must be done before the boring operations can be commenced. Although the end of March is still officially adhered to as the probable date of the launch, it appears as if that ceremony will have to be deferred until the end of April. The smithy and foundry have a little more work than they expected. It having been decided to make guard stanchions and other small fittings for the *Boadicea* here, this necessitated a small increase of hammermen in the smithy, but these men have been obtained from other departments and no new hands have been entered. The extra work in the foundry is owing to a decision to cast in the yard a number of metal fittings for davits and other articles which have hitherto been obtained from contractors. The gunboat *Thrush* was undocked on January 31st and the *Halcyon* was docked a week later. The refit of the former vessel was not at all a large job, it including the re-caulking of the decks, the provision of a new funnel and a few minor defects. The boilers of the *Halcyon* gave most work on that vessel, as some of the tubes required to be removed. Both vessels were ordered to be out of hand by February 25th. The *Thrush* was completed to time, for she left here on the 17th.

H.M.S. "LORD NELSON."

THE prior advent of the *Dreadnought* has robbed the *Lord Nelson* of the pæans of praise and press trumpetings which really should have been her due, as she and her sister, the *Agamemnon*, have taken their place in the Home Fleet with little or no comment generally, although they are really the most powerful battleships designed in the pre-*Dreadnought* era, being very little inferior to the "*Mastodon*" herself. In design she is the connecting link between the *King Edward VII* and *Dreadnought*. The main deck battery of 6-in. guns in the former ship are replaced by 9·2-in. guns on the upper deck in the *Lord Nelson*, while the *Dreadnought* carries six 12-in. guns instead of the ten 9·2-in. guns—natural steps in the cycle of evolution. By adopting the rule-of-thumb method of gauging a warship's fighting power, *i.e.*, comparison of relative weight of discharge per minute, we find the *Dreadnought's* advantage is not so apparent as real; allowing 2 rounds per minute for the 12-in. guns in each ship (all guns would go into action loaded, and the *Dreadnought* has loosed off 3 rounds from one gun in $2\frac{1}{2}$ minutes), and 4 rounds for the 9·2-in. (the *Duke of Edinburgh* scored 10 hits out of 11 rounds with one gun in 2 minutes), the discharges work out as follows:—

ALL GUNS FIRING.

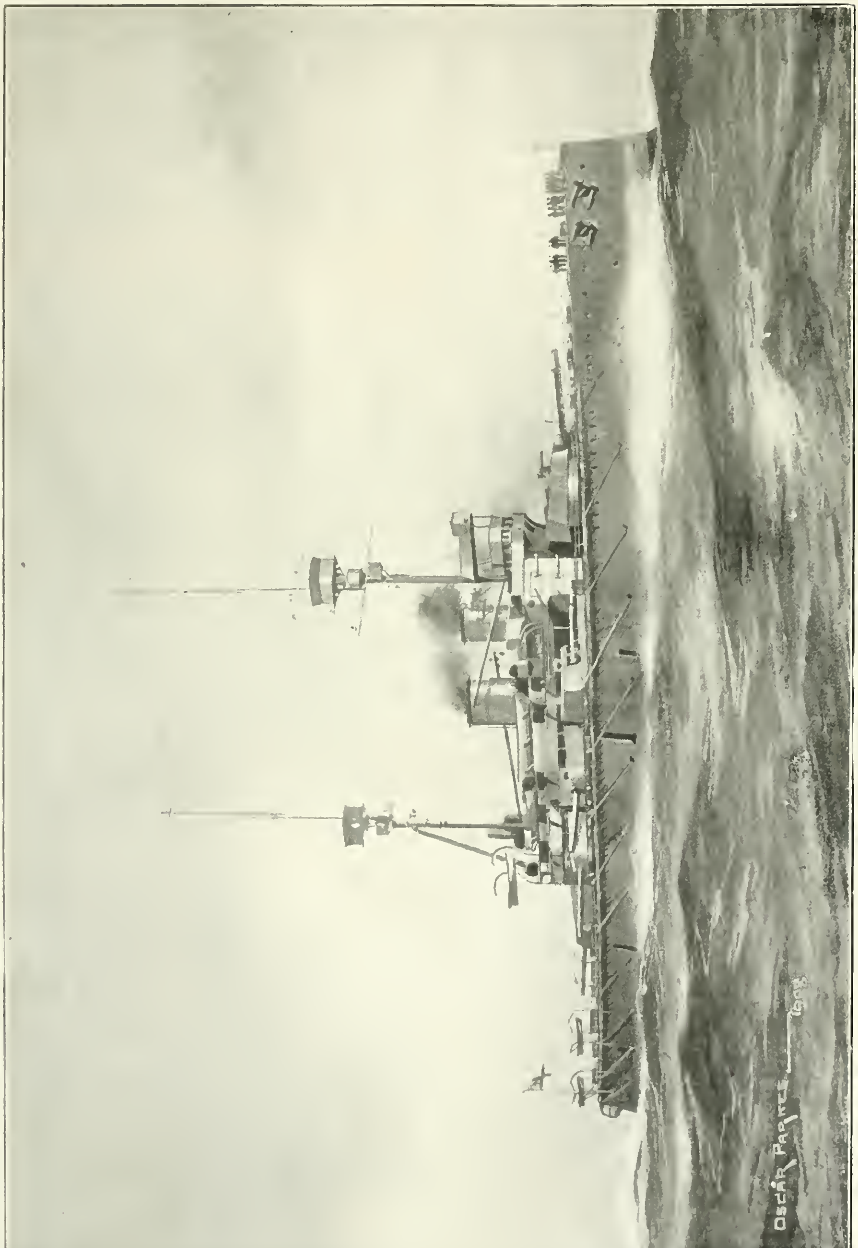
Dreadnought	10	12" (850 lb. shot)		= 17,000 lbs.
Lord Nelson	4	12" (850 ,, ,,)	6,800	= 22,000 lbs.
	10	9·2" (380 ,, ,,)	15,200	



H M S "LORD NELSON"

COMPARATIVE TABLE.

Nationality	British	French	German	Russian	U.S.A	Japan
Name	*Lord Nelson*	*Justice*	*Pommen*	*Imp. Pavel*	*Louisiana*	*Aki*
Date laid down	1904	1903	1904	1903	1903	1905
Displacement (Normal)	16,500	14,900	13,200	17,400	16,000	18,880
Armament—Main	4—12"	4—12"	4—11"	4—12"	4—12"	4—12"
,, Secondary	10—9·2"	10—7·6"	14—6·7"	12—8"	8—8" 12—7"	12—10" 8—6"
,, Tertiary	16—3 pdr	13—9 pdr 10—3 pdr.	20—24 pdr	20—4·7" 4—3 pdr	20—14 pdr 12—3 pdr	8—3"
Torpedo Tubes, Sub	5	2	6	6	4	5
,, ,, above		2				
Armour—Belt	12—4	11—7	$9\frac{3}{4}$—4"	$8\frac{1}{2}$—4"	11—4"	9—6"
,, Side	7"	10"	8"	5—3"	7"	8"
,, Main Battery	14"	$12\frac{1}{2}$"	11"	10"	10—8"	12—8"
,, Secondary	7"	$5\frac{1}{2}$"	$6\frac{3}{4}$"	7"	6"	9—6"
,, Deck	2"	$2\frac{3}{4}$"	3"	3"	3"	3"
Boilers	Yarrow	Niclausse	Schultz	Belleville	Babcock	Miyabara
I.H.P. designed	16,750	18,000	16,000	17,600	16,500	27,000
Speed ,, Knots	18	18	18	18	18	20
Coal ,, Tons	$\frac{920}{2000}$ + oil	$\frac{905}{1825}$	$\frac{700}{1800}$ + oil	$\frac{1500}{3000}$	$\frac{900}{2200}$	$\frac{1350}{2500}$



H.M.S. "Lord Nelson."

ONE BROADSIDE ONLY.

Dreadnought . . .	8	12″		= 13,600 lbs.
Lord Nelson	4	12″	6,800	= 14,400 lbs.
	5	9·2″	7,600	

These results are approximate only. The rate of fire of the amidships 9·2-in. single turret will be faster than the paired turrets, and this is more likely to lower the total than raise it. An equivalent battery of 6-in. guns in place of the 9·2-in. would of course bring the amount even higher, and so on down the gamut *ad infinitum*, but it must be remembered that below the 9·2-in., guns fall off rapidly in penetration and range, so could not be used in the long bowls modern battles will be fought at. The *Dreadnought* has three knots excess speed over the *Lord Nelson*, owing to her turbine machinery, and this would enable her to keep out of range of the 9·2-in. guns, when the preponderance would be on her side. Within the danger zone of the 9·2-in. it is doubtful which ship is the superior in gun power, as the smashing power of the smaller gun is very great, as is also the relative rate of fire. Ship for ship the *Dreadnought* is, of course, the more powerful with her superior protection, but supposing both were of equal mobility and possessing the same defensive qualities it is a moot point whether a mixed armament of 12-in. and 9·2-in. guns is not preferable to the "one type big gun" design. Certainly both should be reinforced with a larger calibre anti-torpedo gun than either carries at present. The three-pounder quick firers of the *Lord Nelson* are preposterously light, and practically useless against modern destroyers. The *Dreadnought's* twelve-pounders are little better; what is needed is a medium battery of 4·7-in. or 6-in. guns—like the new Japanese *Aki*—which can fire an average of eleven shots per minute, any one shot being capable of stopping the biggest torpedo boat if properly placed. The danger zone of a 12-pounder on a modern 230-feet destroyer is comparatively small, although it would probably be quite sufficient to settle one of the earlier types.

A comparative table showing the principle features of each of the last battleships of the Powers designed before the *Mastodon* era is appended. The *Aki* is her superior in every way, and the *Imperator Pavel* and *Louisiana* somewhat inferior, although reference must be made to the Russian Ship's coal capacity. The *Justice* and *Pommen* classes make a bad tail.

In appearance the *Lord Nelson* is noteworthy. She presents, perhaps, the biggest target of any modern ship afloat comparable only to the earlier French "floating-castles." At a time when the Germans are reducing even the moderate super-structure of their *Kaiser* class to lessen target and increase seaworthiness, the bulk of the British ship seems an eye sore from a practical point of view. Taken *in toto* she is the *beau idéal* of a fighting ship externally, her moderate length making the guns look extremely long, while the squat funnels, tripod mast aft, and tiers of hurricane and boat decks amidships give her an unusually formidable appearance; the *King Edward's* look mere Davids in comparison. However neither looks nor "relative discharges" determine a ship's fighting capacity, and from all forecasts the two *Nelsons* will soon be relegated to the second division in the fighting line. We hear rumours of coming giants surpassing the *St. Vincent* in tonnage—anything between 25,000 and 30,000 tons is in the mouths of the Prophets carrying guns of 13·5 in. calibre, and steaming *à la Lousitania*. If these ships ever materialize—"and they will do in time"—all the German *Sachsen** class in the world will never gain the Command of the Sea.

Gas-Producing Plants.—The War Office, we understand, have recently favoured the Mersey Engine and Producer Co., Ltd., with an order for one of their special "H.P." type of gas-producing plants. This plant is to be installed at the Woolwich Arsenal, and the gas produced—which, by the way, is of specially high grade—will take the place of town's gas for special purposes for which ordinary producer gas would be unsuitable. Numerous other large contracts have been placed with this firm recently for this type of gas producing plant, a special feature of the H.P. gas produced from this type of plant being that it has a very high flame temperature, is free from deposit, and is particularly adaptable for many purposes for which ordinary producer gas could not be used.

* Reported 19,000 tons, carrying twelve 11-in. guns.

TORSION-METERS AS APPLIED TO THE MEASUREMENT OF THE HORSE-POWER OF MARINE STEAM TURBINES.*

By J. HAMILTON GIBSON, Member.

WHEN a revolving shaft transmits power it always twists slightly throughout its length. In other words, the end at which the power is applied moves slightly in advance of the end where the work is done, the amount of twist varying directly as its length, directly as the moment of the load applied, inversely as the rigidity of the material, and inversely as the fourth power of its diameter the formula reading :—

$$\theta = \frac{10{\cdot}2\ TL}{CD^4},$$

where θ is the angular displacement in radians, T = twisting moment in inch pounds, L = length of shaft in inches, C = the modulus of rigidity, and D = diameter of shaft in inches. The law holds good absolutely for all shafts which are not stressed beyond the elastic limit. As shafts are usually designed with a large factor of safety, it follows that the amount of twist, or the "torque," as we prefer to call it, is very small. In propeller shafting, for instance, the torque is rarely more than 1 degree for 10 feet of length, so that for a 12-inch shaft the circumferential displacement is only about $\frac{1}{8}$ inch at full power.

Various methods and numerous instruments have been devised to enable an observer to read off the torque of revolving shafting, and such instruments are rightly termed "torsion-meters," or, if self-registering, "torsion-indicators." Many of these instruments are extremely ingenious, and it is proposed in this paper to briefly examine and describe some of them.

The rapidly-growing adoption of steam turbines for ship propulsion has created a demand for some ready means of ascertaining their horse-power, and as the steam engine indicator is not suitable for this purpose, we are thrown back on a torsion-meter as the only known method by which such information can be obtained. The power of a steam turbine may be estimated approximately by calculating the amount of water passed by the feed pumps, or by measuring the number of heat units that pass through the turbines in a given time; but a co-efficient of efficiency must be first determined, and no account is taken of the revolutions in such estimates. As, however, "revolutions" is the very essence of power in dealing with the question of ship propulsion, that would be a very unsatisfactory method of reporting the power from a shipowner's point of view. How often do we hear the claim made that so-and-so's feed-heater, for instance, has given a liner an extra one or two revolutions on the same coal consumption as before? Observe there is no mention of power, because it is recognised that under similar conditions, the maintenance or improvement of the revolutions is the only thing that matters.

Now it is a well known fact that a turbine, unlike a reciprocating engine, passes almost as much steam when standing as when revolving at full speed; and it has therefore become an almost imperative necessity, in fixing the responsibility as between the boiler and the turbine, to know what power the turbine is transmitting to the propeller under varying conditions. The power thus ascertained is called the "shaft horse-power," in contra-distinction to the term "indicated horse power" which has come to be applied exclusively to the results obtained by "indicating" the mean pressures in the cylinders of a reciprocating engine. In this connection "brake horse-power" and "shaft horse-power" are, of course, identical.

A small propeller, working deeply, immersed in smooth water, is a fairly uniform brake, and the turning moment of a steam turbine is also very uniform. Consequently there is little, if any, fluctuation of the torsional stresses in the propeller shafting. If, then, we can ascertain the torque at only one point in each revolution, it may be assumed that, knowing the revolutions, we have all the information required

* Read at the North-East Coast Institution of Engineers and Shipbuilders, in Newcastle upon-Tyne, on January 24th, 1908.

to calculate the work done. It is very different, however in the case of reciprocating engines. The turning moment is anything but uniform, there are several points of maximum and minimum torque in each revolution: in fact, it is not an unknown experience to find that at one or more points in each revolution the torque is negative, that is, the propeller, acting as a flywheel, overruns the engine and actually pulls the engine round after it. In all cases of reciprocating

ARRANGEMENT FOR TESTING TORQUE OF SHAFTING IN SHOP

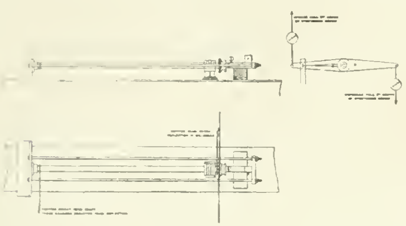


Fig 1

engines, therefore, it becomes necessary to read off the torque at several points in the revolution, the more points the better. The mean torque is then taken in making calculations of power. For a clear appreciation of the problem of torque measurement it is expedient to keep the foregoing facts well in mind, and principally to remember that we are dealing with extremely minute angles: for it is no exaggeration to say that an error of a hair's breadth may mean a difference of several hundred horse-power in the result.

Before applying any form of torsion-meter to a shaft, we must know its "modulus of rigidity," that is, how much it will twist with a given static load applied at the end of a lever of known length. This can only be done satisfactorily in the workshop, preferably on a long rigid lathe bed, Fig. 1. One end of the shaft is securely fixed and a twisting moment applied at the other end. To eliminate the effect of friction in the supporting bearing at the free end it is advisable to use two levers, one at either side, as shown in the illustration, and the loads are preferably applied by graduated spring balances. Two pointers independent of the load levers are secured to the shaft as far apart as practicable, and the difference in the angular movement of these two pointers gives the true twist for that length of shaft. If the pointers are made 57·3 inches long from the shaft axis, their ends will

THE "FOTTINGER" TORSIONMETER.

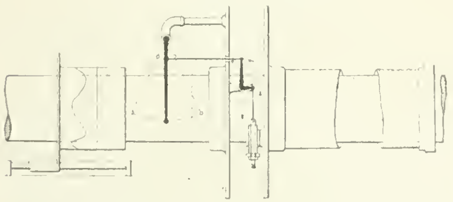


Fig 2.

describe 1 inch of arc for 1 degree of twist, and a decimally divided straight edge will then measure the twist to within $\frac{1}{100}$ of a degree, which is quite near enough for all practical purposes, and we can proceed to calculate the modulus of rigidity from the formula.

Observe that a propeller shaft is subject to two distinct stresses. Not only is it twisted as between the engine and the propeller, it is also compressed longitudinally by the propeller thrust, the compressive stress being sometimes as much as 20 per cent of the shear stress at the surface of the shaft, produced by torsion alone. This compression augments the torque by an appreciable amount which has been actually measured in numerous experiments, and may be taken roughly as 3 per cent. for hollow shafts and 1 per cent for shafts which are solid. It might be considered sufficient to calibrate only one shaft in a multiple screw vessel; but it is found that similar shafts, with identical tensile and elongation tests, have different moduli of rigidity probably due to their varying elastic limits and some slight difference of homogenity in the material. The only way therefore to ensure

FOTTINGER DIAGRAMS.

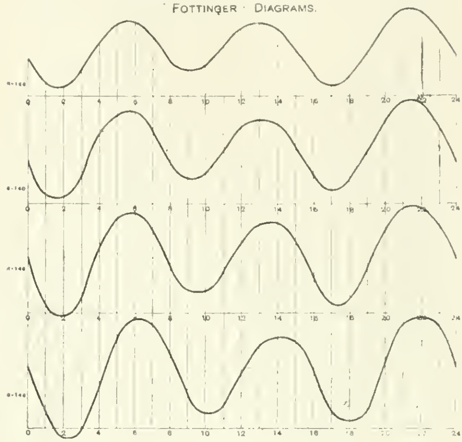
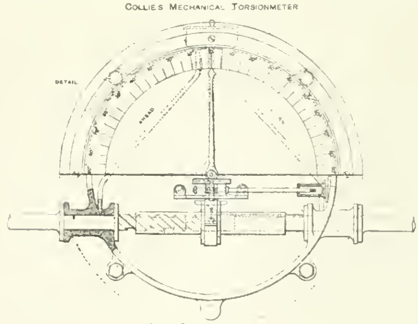


Fig. 3.

accuracy is to calibrate each shaft separately and to build up a power diagram, as shown in Fig. 2, for each.

Another point to bear in mind is that a working propeller shaft is "alive," and this condition must be imitated as far as possible during calibration by jarring the shaft with repeated blows of a mallet, so as to keep the mass in a state of molecular vibration. Otherwise the phenomenon of mechanical hysteris, so marked in some static experiments, will obtrude itself and vitiate the results.

COLLIE'S MECHANICAL TORSIONMETER



ARRANGEMENT.

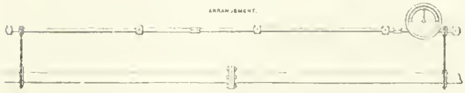


Fig 4

Having established the true modulus of rigidity for each shaft, we may proceed to build up our power diagrams based on the formula,

$$H = \frac{\theta D^4 N}{CL}$$

where H = shaft horsepower, θ = torque in degrees, D = diameter of shaft in inches, N = number of revolutions per minute, C = constant varying with the modulus of rigidity, and L = length of shaft in inches. In this formula we have all the elements for obtaining the shaft horse-power, and it only remains to ascertain the number of degrees of torque by means of a reliable and accurate torsion-meter. Naturally a mechanical engineer would employ mechanical means for the purpose, in the first instance at any rate, and we will describe two such means that have been tried with varying success.

Dr. Fottinger's apparatus (Fig. 2), has been used on several German boats, and consists essentially of two stiff tubes encircling, but free of, the shaft, except at their remote ends, where they are rigidly secured to the shaft. The free ends of each tube are brought together and terminate in a pair of discs, the discs revolving with the shaft in parallel planes. Assuming the discs to be 2 feet diameter and the two points on the shaft to which the tubes are secured to be 10 feet apart, the edges of the discs will then have about ¼ inch movement relative to one another at full power. Means are introduced to multiply this movement by the employment of links and levers, and the torque is recorded by an indicator pencil moving round a fixed paper cylinder concentric with the shaft. When there is no torque the line drawn by the pencil is a continuous circle in the same plane, and this line represents the zero or base line from which the subsequent torque indications are measured. When the shaft transmits power "ahead" the indication for varying torque, as in a reciprocating engine, is a wavy line on one side of the base line. For "astern" power the indication is, of course, on the opposite side. The back lash of the link work is taken up by light springs to steady the pointer or pencil.

Several diagrams taken by a Fottinger meter are shown in Fig. 3, which exhibit clearly the fluctuating torque of shafting driven by reciprocating engines, and at full power a negative torque is seen, as previously referred to, at that period of the revolution where the propeller overruns the engine.

Another form of mechanical torsion-meter is that of Mr. Collies (Fig. 4). Instead of tubes encircling the shaft, which are limited in length by the distance between the couplings and the plummer block bearings, two light countershafts parallel to the main shaft and driven from it at their remote ends by sprocket wheels and chain gearing are carried over head. Their free ends are screwed into each other, one of them forming the nut and having a limited longitudinal movement, whilst the other has none, merely revolving in a small thrust block. As one end of the main shaft revolves slightly in advance of the other, the countershafts screw themselves into or out of one another according to the direction of rotation of the main shaft by an amount depending on the power transmitted. The longitudinal movement is transferred to a pointer and rendered visible on a dial which is graduated on either side of the zero into so many degrees of torque "ahead" and "astern." The back lash of the gear is taken up by springs as in the Fottinger meter and it is a simple matter to add a continuous recording apparatus, if such be required.

As a variant on the concentric tube and countershaft methods of measuring the twist of a shaft by means of a parallel member not exposed to torque, several inventors have made use of the fact that some main shafts are hollow, and fit an inner shaft loosely fitting the bore (Fig. 5). One end of the inner shaft is secured to the main shaft and to the other end is fitted a pointer or spider, the radial arms of which emerge through grooves cut in the face of a coupling between the coupling bolts. The spider shows the same movement as the remote fast end of the inner shaft, and moves relatively to the coupling at which it emerges. Various devices are adopted to show and record the relative movement which, of course, gives the torque of the main shaft for the length of the inner shaft.

The best-known electrical torsion-meter is the Denny-Johnson apparatus (Fig. 6), which has been frequently described in technical publications. Briefly, it is made up of two revolving armatures secured to the shaft as far apart as possible. Each armature has a pointed or chisel-shaped magnet which moves over, but does not quite touch a finely wound coil. The coils are connected up in series through a Wheatstone bridge arrangement to a telephone receiver. When no power is being transmitted the relative positions of the revolving magnets and coils are identical at each revolution, and no sound is heard in the telephone receiver. But when the shaft twists, the armatures get "out of step," as it were, and a clicking sound is heard until the pointer in the recording box is moved by an amount equal to the number of windings in the coils, indicating that one magnet is ahead of or astern of the other, until silence again ensues, and thus the angle of torque is caught and measured.

Some time ago, Mr. Gardner, of Fleetwood, made an electrical torsion meter based upon the varying amount of current permitted to flow through a wire connected up to an ordinary ammeter (Fig. 7). Notched discs or interrupters are fitted to the shaft at a reasonable distance apart, and the notches are filled with non-conducting material, so spaced that the conductor and non-conductor are the same length measured round the periphery of the discs. A brush lies lightly against the edge of each armature, the width of the brush tip being exactly equal to the length of a notch. When no torque is being transmitted, one brush is in full contact on one disc, and the other brush is adjusted so as to be just out of contact on the other disc. Therefore the circuit is interrupted no current flows through the system and the ammeter stands at zero. Immediately the shaft twists, however, the relative positions of the discs and brushes are altered and current flows through the system until a maximum is reached, when both brushes simultaneously overlap the conductors by half their width. The width of the brushes and notches are pre-determined to register the full power torque of the shaft.

Recently Messrs. Barr & Stroud, the makers of the artillery range finder which bears their name have brought out a torsion meter which is apparently based on the same idea as that of the Gardner apparatus, but no details are as yet available.

Clever and ingenious as these mechanical and electrical instruments undoubtedly are, and manufactured with the

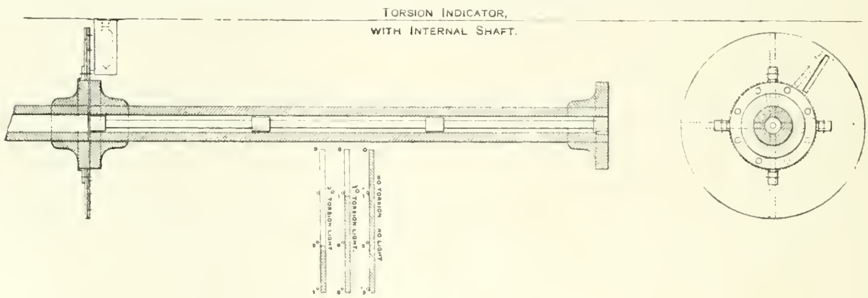


Fig. 5

greatest possible skill, they all leave something to be desired in the matter of accuracy when it comes to the measurement of power. Every link in the chain between the main shaft and the recording apparatus introduces a possible source of error, and, as has been pointed out, an error even of the proverbial hair's-breadth means a fairly large percentage error in the horse-power result. In mechanical torsion-meters the multiplying gear necessarily involves a multiplication of whatever error there might be, whilst there are more insidious causes of error which creep in in an electrical apparatus, such as variations due to battery resistance, temperature effects, slight dragging of the commutator sections and brush tips, metallic dust or damp on the contact surfaces, and so on.

We turn therefore to other methods, and proceed to describe those torsion-meters which depend on the action of a beam of light.

Herr Frahm, of Germany, and Professor Hopkinson, of Cambridge University, have been working for some time on the same lines, and each has evolved an apparatus so similar that probably the same description will suffice for both (Fig. 8). Starting with the concentric tubes and parallel discs of Fottinger's mechanical apparatus or their equivalent, the line work for recording purposes is dispensed with and a small plane mirror is used pivoted to the edge of one disc, and oscillated by a projection on the other disc. As the relative

"DENNY-JOHNSON" APPARATUS.

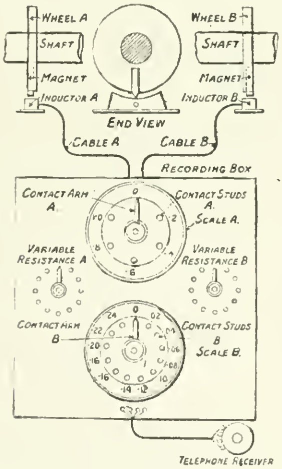


Fig ʼ.

movement between the discs increases, so the plane of the mirror is altered. A beam of light from a fixed lamp is projected on to the edge of the discs, and at each revolution of the shaft it is caught on the mirror and reflected on to a graduated scale. In a dark chamber such as a shaft tunnel the streak of light from the mirror on the rapidly revolving apparatus is almost continuous, and the graduations are read off with tolerable ease; but the almost inevitable spreading of the light beam adversely affects the accuracy of the reading.

Mention should be made of a neat torsion-meter device invented by Amsler of planimeter fame (Fig. 9). A concentric sleeve is fitted on the shaft and the free end brought close up to a fixed collar. A short scale is engraved on the collar, and a pointer or vernier on the free end of the sleeve, something like the marks on a micrometer calliper gauge. As the shaft twists the pointer moves along the scale. The problem now is to read the scale as it is flying round with the shaft. Here advantage is taken of the instantaneous duration of an electric spark. Contacts are fitted on the shaft just in advance of the scale, and a spark throws a powerful light on to the polished scale once in each revolution, so that the scale, however fast the shaft is revolving, appears to stand still, and thus the torque in degrees is read off directly.

The Bevis-Gibson flashlight torsion-meter (Fig. 10), has undergone searching tests during the last eighteen months. Starting with the well-known physical facts that the velocity of light is practically infinite, and that light rays travel in

Fig 7

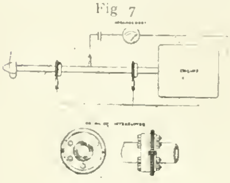
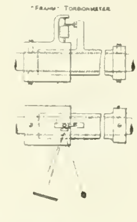


Fig. 8.



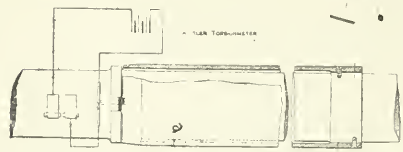
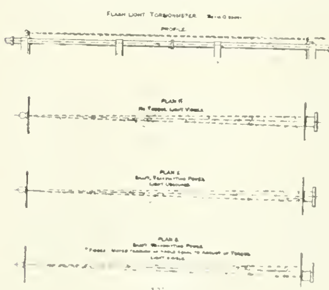


Fig 9.

absolutely straight lines through air of even density, it was conceived that some simple means of applying these principles to a solution of the problem of shaft torque should be forthcoming. The usual trial and error work with which inventors are so painfully familiar followed, and eventually the flashlight torsion-meter was evolved and put into use. By a mental process of elimination it was decided at the outset that the less "gear" the better. The angles to be measured are so inconceivably minute, and in a rapidly revolving shaft the time intervals are so inconceivably short, that nothing but an absolutely direct reading can give a true result.

The method adopted can be best shown by a diagram (Fig. 11.). Two blank discs are mounted on the shaft at a convenient distance apart. Each disc is pierced near its periphery by a small radial slot, and these two slots are in the same radial plane when no power is being transmitted and there is no twist on the shaft. Behind one disc is fixed a bright electric lamp masked, but having a slot cut in the mask directly opposite the slot in the disc. At every revolution of the shaft, therefore, a flash of light is projected along the shaft towards the other disc. Behind the other disc is fitted



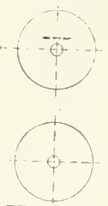


Fig 11

Fig. 10

the torque-finder, an instrument fitted with an eyepiece and capable of slight circumferential adjustment. The end of the eyepiece next its disc is masked, except for a slot similar and opposite to the slot in the disc. When the four slots are set in line, a flash of light is seen at the eyepiece every revolution, and if the shaft revolves quickly enough the light will appear to be continuous. This effect is apparent at anything over 100 revolutions per minute. At lower speeds the flash is seen to be intermittent, but this in nowise affects the

accuracy and reliability of the result. At each end of the shaft, therefore, we have what is virtually an instantaneous shutter fixed, be it noted, directly to the shaft, and there is no connecting link or gear between the discs either mechanical or electrical, except the beam of light which flashes once in each revolution clear through the two shutters. Let us suppose now the shaft to be transmitting power. One disc lags behind the other by a definite amount and although three of the slots are still in line, the fourth slot, namely, that in the lagging disc, effectually blanks the flash and no light is seen at the eyepiece.

This is where the function of the "torque-finder" (Fig. 18) comes in. To pick up the light again the eyepiece must be moved by an amount equal to the circumferential displacement of the lagging disc. This is accomplished by manipulating the micrometer spindle of the torque-finder, on which is a scale and vernier graduated in degrees. While the scale is fixed its vernier moves with the eyepiece, and the graduations are so marked that by the aid of a simple microscope conveniently hinged, differences of $\frac{1}{100}$ of a degree can be readily discerned. For shafts of ordinary size the scale is set at 13·6 inches radius from the centre

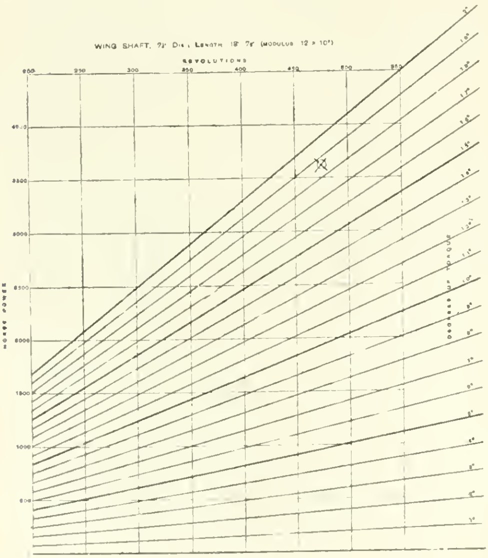
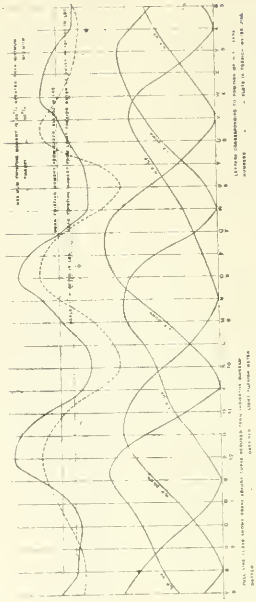


Fig 12

of the shaft, so that the degrees are about ¼ inch apart. One-hundredth of a degree therefore means $\frac{1}{100}$ of ¼ inch, or $\frac{1}{400}$ of one inch. As an ordinary shaft twists 1 degree in 10 feet at full power, it is therefore possible to get the shaft horse-power to within 1 per cent. of full power. But as it is frequently possible to fit the discs 40 or 50 feet apart even this accuracy may be improved upon, and powers ascertained to within ¼ of 1 per cent. of full power. Users of the ordinary steam engine indicator will readily appreciate what this means, for indicated horse-powers are frequently wofully erratic. When we consider that a steam engine cylinder is often some thousands of times greater in area than the small indicator piston, we get some faint notion of the effect of multiplication of error. Add to this the friction of the engine piston, the piston rod, the guides, and the connecting rod joints, and we begin to realize how much more reliable is shaft horse power than indicated horse power. For purposes of scientific data, especially in reference to ship propulsion, the latter term will no doubt soon become obsolete and retire into the comparative obscurity of nominal horse power and other like terms.



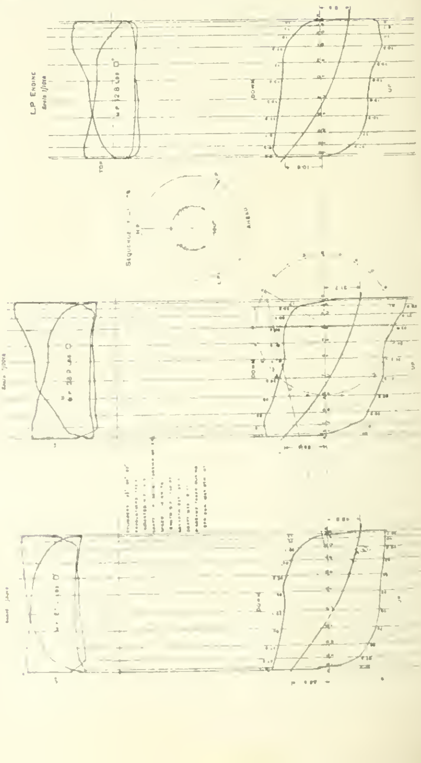


Fig. 14
COMPARISON OF CRANK EFFORT AND TORSIONMETER DIAGRAM

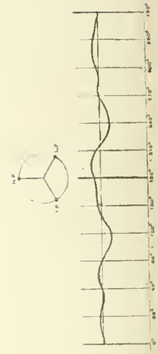


Fig. 13.
MEAN TWISTING MOMENT DIAGRAM FOR A RECIPROCATING ENGINE

The slots in the torsion-meter discs are necessarily of appreciable width (Fig. 19), and in moving the torque-finder over the light is visible for some distance along the scale. The light comes into view, attains a maximum amplitude and brightness and fades away as the eyepiece moves along the scale. If it were possible to gauge the exact point where the light attains a maximum, that is the point that would be used. Failing this, however, use is made of one edge of the slot. The finder is moved always in the same direction in taking readings, and stopped at the exact point where the light is cut off. So delicate is the sense of sight that a movement of $\frac{1}{100}$ of a degree is sufficient to mark the difference between light and darkness. A zero reading is taken when the shaft is revolving idly, if possible at or near full speed, and this reading forms a base and is subtracted from any subsequent power readings.

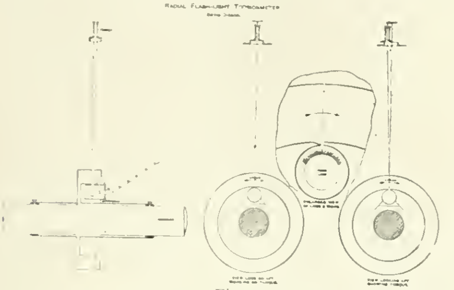


Fig. 15

Let us see how this works in practice by employing a mechanical lantern slide. First, suppose the shaft to be revolving idly. The finder is moved over until the light is just disappearing, and the vernier is seen to be standing at .53 degree. Now, suppose the shaft to be transmitting power. The discs have twisted relatively to one another, and no light is seen until the torque finder is moved the same amount. Having picked up the light the finder is worked gently over until the light is just disappearing again. The reading is now 2·39 degrees. Subtract from this the zero reading of ·53 degree and we get the true torque, namely, 1·86 degrees. Now to apply our shaft horse-power diagram (Fig. 12) referred to in the earlier portion of this paper. We will suppose that the revolutions are 475 per minute. The torque is 1·86 degrees, and finding the intersection of the lines on the diagram the power is seen to be 3,620.

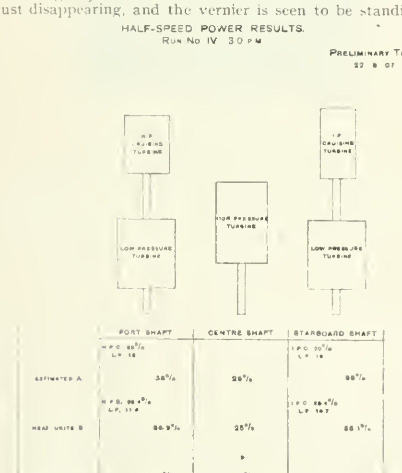


Fig 16.

It is perhaps scarcely necessary to point out that the whole operation takes much less time than its description. Indeed, it is possible to produce the shaft horse-power on a trial trip immediately on the termination of each measured mile run, and to hand a slip to the officer in charge similar to that shown in Fig. 20, containing all the information, in plenty of time for him to make any necessary adjustments before coming back on the straight for the next mile.

FIG. 20.—FLASHLIGHT TORSION METER RESULTS.
Engines, No. 1215.

Vessel H.M.S. *Indispensable*. Date, 31st November, 1907.
Trial, Official Full Power. At Clyde.

Shaft.		Run.	Steam at H.P. Recvr.	Revs. per Minute.	Reading.	Degrees Torque.	Shaft Horse-Power.
Stard.	Wing ..	IV.	180 lbs. □″	710	5·90	1·26	8,300
	Centre ..			680	6·02	1·20	7,480
Port	Centre ..			687	4·64	1·21	7,520
	Wing ..			707	5·74	1·23	8,270
Mean revolutions				696	Total ..		31,570

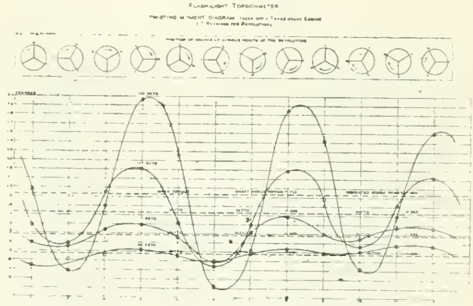


Fig. 17.

For reciprocating engines a simple modification of the flashlight torsion-meter enables the operator to take several readings—usually twelve—in one revolution of the shaft. The discs are perforated with twelve slots arranged in the form of a spiral—one at each 30 degrees of the circumference (Fig. 11). The lamp and torque-finder must be moved radially from the shaft, so as to bring them into line with each corresponding pair of slots in the discs. By spotting the readings on a sheet of squared paper and sketching in the curve (Fig. 13), we get an actual twisting moment diagram from which the mean torque is readily obtained. The mean torque with the revolutions is then referred to the power diagram and the shaft horse-power read off as before.

This modification of the apparatus is only required in the case of shafting driven by reciprocating engines. In a recent vessel an interesting comparison in this connection was made (Fig. 14). A crank-effort diagram was built up in the usual way from the indicator diagrams, due allowance being made for the effect of the inertia of the moving parts, and the torsion-meter twisting moment diagram drawn down to the same scale. The latter curve corresponds closely with the crank-effort diagram, but the variation from the mean is greater in the shaft torque diagram, due probably to the action of the propeller and the torsional oscillations thus set up. It will be noticed that the dotted shaft diagram is consistently below the crank-effort diagram, the mean difference being about 10 per cent. This difference corresponds almost exactly with the result obtained by steaming and indicating the engines disconnected from the propeller in the wet basin before the underway trials, and forms a striking check and corroboration of the two curves. Cases sometimes occur, especially in modern warships, where a long length of shafting is not available for torsion-meter purposes and recourse must be had to a special form of apparatus.

To meet this contingency, another modification of the flashlight torsion-meter is used, in which the beam of light,

instead of flashing axially along the shaft, is made to flash radially through slots in concentric drums, and is caught by a torque finder at some distance from the shaft axis (Fig. 15). The drums are fixed to the shaft only two or three feet apart, and the relative movement due to shaft torque is naturally very much less than that of the discs in the axial form of torsion-meter. A masked lamp is fitted inside the smaller drum next the shaft, and so close to the drum that when the shutter opens the source of light is exactly at the shutter. The outer drum is made as large in diameter as can be conveniently arranged, the radial distance between the drums, as compared with the distance of the torque-finder from the

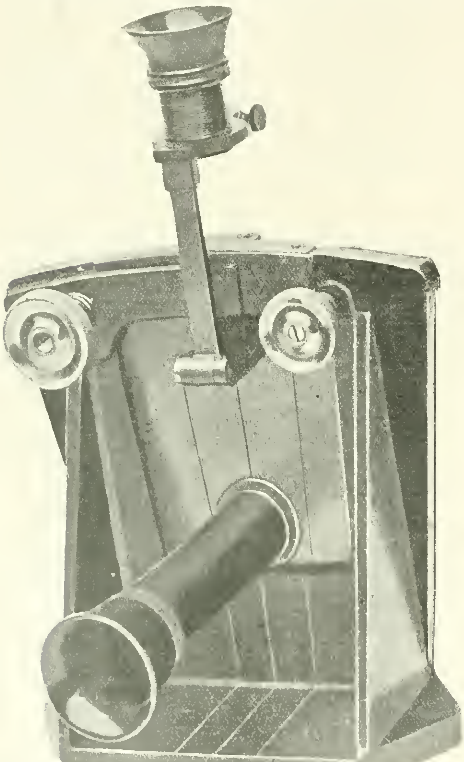


Fig 18

source of light giving by direct proportion the required multiplication of effect, and enabling the torque, as before, to be read off with extreme accuracy, considering the short length of shaft available. The light in this case is cut off by three knife edges—one at the lamp, one at the inner drum, and one at the outer drum, the eyepiece being fitted with a diaphragm pierced by a minute pin-hole in the centre. The extreme sensitiveness of the apparatus is almost incredible. The angle of the flashing beam proceeding radially from the shaft can be measured to $\frac{1}{1000}$ of a degree, so that although only three feet of shafting may be available the result is as good as if a 30-feet length had been used with an axial-ray apparatus.

Radial flash torsion meters are not quite so simple in construction as the axial-flash type; but there are certain obvious advantages besides its applicability to a short length of shafting. For instance the flash might be led vertically upwards through a tube in a deck immediately overhead and the readings taken at will in the seclusion that a cabin grants, instead of in the engine-room or tunnel. In the practical application of the flashlight torsion meter to various vessels fitted with steam turbine installations some very interesting results have been forthcoming, which are set out in tabular form in Fig. 21.

Attention is specially directed to the immense range of the apparatus. Some of the low powers recorded are less than half of 1 per cent. of the full power. If indicated horse-powers of such small amount were required to be taken from a piston engine, the indicator spring would have to be changed for a very weak one to get a reasonably accurate card; but no such change is required in the apparatus we are considering.

Then again, the distribution of power in a turbine installation can only be approximately estimated. The steam is turned into the high-pressure turbine and left to follow its own devious course through the successive turbines on its way to the condenser. At low powers it is sometimes found that the high-pressure turbine shows the most power, whilst for overloads the lower-pressure turbines have the advantage. In Fig. 16 the percentage distribution of power is shown by three sets of figures—for a three-shaft turbine installation, including high pressure and intermediate cruising turbines. Set A shows the estimated or designed distribution, Set B the calculated distribution from the pressure gauge readings at the terminals of each turbine, and Set C shows the actual distribution of power over the three shafts as ascertained by flashlight torsion-meter readings.

Fig 19

Fig. 21. TURBINE STEAMER."
FLASH-LIGHT TORSION-METER.

Actual readings and corresponding horse-powers taken during trial trips under varying conditions of displacement and propellers.

Turbine Shaft.		Degrees Torque.	Revs. per min.	Shaft Horse-Power.	S.H.P. Total.
Starboard	L.P.	1·43	482·9	2,775	
Centre	H.P.	1·69	461·2	2,600	7975
Port	L.P.	1·37	472·8	2,600	
Starboard	L.P.	1·32	461·2	2,410	
Centre	H.P.	1·65	426·8	2,330	6940
Port	L.P.	1·24	457·3	2,200	
Starboard	L.P.	1.15	426·4	1,970	
Centre	H.P.	1.52	417·6	2,080	5960
Port	L.P.	1.13	418·9	1,910	
Starboard	L.P.	1·05	418·4	1,765	
Centre	H.P.	1·52	422·3	2,120	5555
Port	L.P.	1·02	415·5	1,670	
Starboard	L.P.	·21	198·6	162	
Centre	H.P.	·27	206·3	185	495
Port	L.P.	·19	183·5	148	
Starboard	L.P.	·22	146·7	88	
Centre	H.P.	·21	171·4	87	257
Port	L.P.	·13	144·8	82	
Starboard	L.P.	·07	46·3	13	
Centre	H.P.	·05	86·1	15	37·2
Port	L.P.	·01	24·4	9·2	

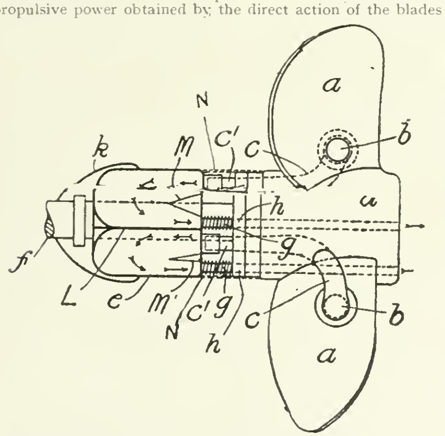
Referring again to Fig. 21, it will be seen that the starboard low-pressure turbine shows throughout the series more power

than the port. Investigation showed that the blade tip clearances of the two turbines differed slightly, and a further comparison proved that the percentage difference of clearance was just sufficient to account for the differences of shaft horse-power recorded.

In a recent progressive trial of a vessel fitted with triple expansion engines, flashlight torsion-meter readings were taken at varying speeds, as shown in Fig. 17. Plotting these results in a manner before described, we notice an almost alarming fluctuation of torque as the power increases, and at one point, namely, where the intermediate crank is at right angles coming up, and the low pressure has just opened full to steam on the down stroke, the high pressure being just past cut-off, the propeller overruns the engine and the torque is negative.

Other observations and comparisons might be made: but enough has been said to indicate the advantages and possibilities of shaft horse-power results and we must conclude that whichever type of torsion-meter comes into general use, on the inexorable principle of "the survival of the fittest," the torsion-meter in some form or other has come to stay.

The screw propeller has a fascination for the inventive faculty of both engineers and laymen; the patent office and its threshold have records and echoes respectively of ideas which have been embodied in models to prove originality. Many of the embodiments are simply modifications of previous ideas. Our attention has been called to a design which is new in respect to its details, and the application of these to the propulsion of the ship. It is stated to have been tested against an ordinary propeller exactly similar in shape, pitch and area with satisfactory results, on a model boat. It is at least interesting as a record of the ingenuity which finds an outlet in such work. The specification states that "This invention relates to improvements . . . in which the propulsive power obtained by the direct action of the blades



on the water is increased by the action of jets of water which, as the propeller revolves are caused to flow through tubular passages in the propeller boss into a chamber sliding on the propeller shaft and connected to the boss by means of springs, said chamber is divided into sections according to the number of blades, each blade having its own watercourse in the chamber. The inflow being larger than the outflow, the pressure is maintained in the forward end of the chamber, the springs being stretched and a thrust movement applied to the propeller shaft, which increases the speed of the ship. The thrust power may be either through the perforations in the blade or the after edges of same. Exhaust tubes are led from the said chamber and are passed through the propeller boss so that rearwardly directed jets are forced against the water behind the propeller and by reaction assist in driving the ship ahead. As illustrated by the diagram each propeller blade *a* has a perforation *b* and has cast thereto a tubular passage *c*, which is led to the propeller boss *d*. Connected to the tubular passages are tubes *c1* telescoping into a hollow casing *e* arranged to rotate with, but slidable on, the propeller shaft *f*. Exhaust tubes *h* of smaller diameter than the tubes *c1* are led from the casing through perforations in the boss *d* Casing *e* is connected with the boss *d* by a spring or springs. The hood *k* is fixed to an A-bracket or bush serving to reduce any retarding action due to friction. L are partitions in the casing dividing the casing into compartments according to the number of blades each blade having a separate compartment. M are triangular partitions which give the water the desired course and prevent accumulation of water at the far end of the casing. As indicated by dotted lines the hood N is between the casing *e* and the propeller boss, being fixed to the casing and fitting a recessed portion of the boss. By the action of the propeller revolving the water is forced through the perforation *b* in each blade *a* and through the tubes *c1*, and enters the casing *e* with great force, causing the casing to slide forward so as to extend the spring or springs *g* between the propeller boss and casing *e*. The water then returns through the tubes *h*. The tubes *c1* being of greater area than the tubes *h* the pressure in the casing is maintained, and the water returning through the tubes *h* strikes the water at the rear end of the boss with great force, again increasing the speed of the ship."

Those who have had the privilege of visiting different workshops both in Britain and across the seas can point out a contrast, which has become very great during the past twenty years, between new methods and old. The care and attention bestowed upon the building and the details of a workshop at the present day are very marked. The arrangement of the machines, the store, the tool dressing shops and the labour-saving appliances, has become an exemplification of method and a fine art; while the provision made for the comfort and convenience of the workmen is such that in most of the reorganized workshops nothing is left to be desired. Cleanliness is a feature which is conspicuous and in some cases rewards are given to the machinist who maintains consistent excellence in keeping his machine and its immediate surroundings in a state worthy of the highest praise. The modern factory is an illustration of the principle that method and cleanliness in unison go far towards a guarantee of success in the direction of carrying on work to the best advantage. More than this, is undoubtedly necessary for success in business, the method and organization of the structural portion of the building is only one part of the whole, the other parts require no less attention, but speaking generally the former part is an evidence that the remaining parts are not overlooked. The employer who provides a building with all the modern improvements should, and probably does, get better service and better work from his workmen than another who, wrongly thinking that cheapness and economy are synonymous terms, allows old buildings, old tools, old methods and the fallacious policy of "let it suffice", serve. In the competition which every manufacturer has to face now, both from competitors at home and abroad, it behoves one to consider well and wisely where improvements can be made to secure better service and improved output, with room for development, at possibly the expenditure of more capital. That there are largely in use in this country, but manufactured abroad and imported, articles which could be made within the borders of Britain, is well known; in some cases these articles are manufactured abroad for the British market, because continental machines have been constructed with a view to the possible requirements of customers present or prospective. This applies more to textile factories and to some extent it is due to the deftness of handiwork which has been acquired through generations of experience, but beyond this it does seem as if British (or Brirish as has been suggested) manufacturers should be able to cope with these articles did they but rise to the occasion.

Institution of Naval Architects.—The annual meetings of this Institution will take place on Wednesday, April 8th, and the two following days, in the Hall of the Society of Arts, John Street, Adelphi, W.C. (by kind permission of the Council). The Right Hon. the Earl of Glasgow, G.C.M.G., LL.D., president, will occupy the chair. The annual dinner will be given on Wednesday, April 8th, in the Grand Hall, Hotel Cecil, Strand, W.C., at 7.30 p.m.

WHITE STAR WORKS APPRENTICES' PRIZE DISTRIBUTION.

ON 21st January, at the above works in Liverpool, the pleasing function of the presentation of prizes by H. Concanon, Esq., assistant general manager of the White Star Line, took place in the presence of the various heads of departments, including Mr. W. J. Willett Bruce (supt. engineer), who presided, Messrs. H. S. Boumphrey, C. A. Allen, J. A. Harkness, H. M. Ormston, J. F. Gobey and J. H. Parker.

It is worthy of note that in the White Star works some three years ago a system of marks was instituted, under which the industrious apprentice gains immediate recognition, an important feature in the system being the necessity of passing in two technical subjects.

Mr. Willett Bruce opened the proceedings by giving the following address :—

"I have no doubt you are all aware why I have gathered you together this afternoon — to meet Mr. Concanon, who has come down here to say a few words to the two apprentices who have succeeded in obtaining the company's prizes under the system recently instituted for you boys, not only to make you better engineers, but better men. I may say that Mr. Concanon has always shown a most lively interest in the works, in the welfare of its staff and those generally connected with it, and I may say as your superintendent that he has been always willing and ready to advance the interests of all, and partitularly of those boys who prove themselves successful in obtaining the required number of marks and in attending their classes, and I hope you will all go on trying to improve yourselves both for the benefit of the company's interests and your own. I will now call upon Mr. Concanon to address you and distribute the prizes."

Mr. Concanon, before presenting the prizes, addressed the gathering, and said :—

"I am asked by Mr. Ismay, who is your chief and mine, to say how much he would have liked to be here to-day, but you will readily understand that his time is so fully occupied by his important and numerous business engagements, not only as head of the White Star Line, but also as president of the Associated Companies, that it was quite impossible for him to come, and he has asked me to come in his place. Now, it is a very great pleasure indeed for me to be here, for, as Mr. Willett Bruce has told you, I take a special interest in the White Star works, as one of the principal branches of the White Star Line, and I do not hesitate to say that in my opinion these works are as well run as any of the neighbouring establishments, if not better. Now, some time ago (some of the older people of the staff here will recollect) we had no such system of bringing in youths as apprentice engineers, fitters, etc., except on a fixed graduated wage ; but when Mr. Willett Bruce was appointed superintendent, he brought forward a scheme, and said that he thought the best way of teaching them their trades would be by instituting a systematic arrangement of marks for ability and diligence in the workshop, conduct and good time keeping, inclusive of certain privileges, one of which is a fixed summer holiday. He was then asked by the managers to draw up a form of indenture, which in a way would bind you to us and us to you. Your tuition would thus become more systematic, and by offering better prospects, your position in the company would become more assured. Mr. Willett Bruce also stated that he did not think any apprentice engineer or other tradesman would be satisfactory who did not show a desire to avail himself of the technical classes which are now so general in this country, and which are doing so much to raise the status of all tradesmen, and this important feature was accordingly embodied in the scheme. Mr. Willett Bruce has taken a very great interest ind'ed in the apprentices of these works ; Mr. Ismay himself knows the names of some of you, and now and again asks how you are getting on. The management, being so pleased with the scheme, offered two prizes annually value £5 5s. each to the two apprentices having the highest number of marks. It was very difficult indeed to arrange system of marks, and I think you all know the prizes are fairly awarded and that the heads of the departments show no favouritism. Mr. Willett Bruce, Mr. Boumphrey and Mr. Ormston have no more feeling for the engineers' department than they have for the joiners or that of any of the others ; the marks are distributed according to merit, the results being submitted to us at James Street, when we select the prize-winner. It is quite possible that some of the apprentices are under the impression that there are no subjects beneficial to their particular trade to put them on lines similar to the engineers, and Mr. Willett Bruce has given me a list here which I will read to you, showing how apprentices other than engineers can benefit by the scheme.

Engineers', Blacksmiths', Brassfinishers' and Electrician apprentices may take a course of study covering three years from the following list of subjects, as may be considered advisable, to meet the particular requirements of the student: Practical mathematics, pure mathematics ; mechanics, theoretical, applied and experimental ; steam ; practical geometry, plane and solid ; graphic statics ; machine construction and drawing ; heat ; workshop practice, pattern making, moulding, smith's work, fitting and turning, etc.

Sheet Metal Workers' Apprentices, Boilermakers' Apprentices, and Coppersmiths' Apprentices may take certain of the above subjects together with a special study of metal-plate work.

Joiners' Apprentices may take a course of study covering three years from the following list of subjects, as may be considered advisable to meet the particular requirements of the student : Practical or pure mathematics, building construction, practical, plane and solid geometry, geometrical drawing, graphic statics, drawing (freehand and model), woodwork, carpentry and joinery.

"Now, as regards time-keeping, we have found a difficulty in arranging marks for time-keeping, owing to a difference in the several departments. Joiners, for instance, I think, come in later than others in winter, and it has been now decided that all apprentices in the scheme start at six o'clock in the morning, summer and winter, but in the case of the joiners this is only a trial ; whether it will be permanent or not depends upon those engaged in that particular trade. We do not want to revolutionize a system unless it is generally desired ; the idea which is at present in vogue is to put all the apprentices on the same footing to compete for these prizes, and not to get more work out of you. If you do not desire to compete with the others, I daresay we will go back to the old system. Now for the prizes. The winner of the first prize is Mr. Lawrence Parker, and the greatest credit is due to him for winning the prize again this year, because he won it last year, obtaining the maximum number of marks, but the other departments should take good care he does not win it next year. The winner of the second prize is Mr. George Daymond, who, I am sorry to say, is not here to-day, being ill. I hope his mates at the bench will convey to him our congratulations, and say we hope he will long be able to wear this watch and continue in the company's services.

"Boys, one thing more ; this winning of the prizes is not the result of cricket or football, nor firing at the Altcar Range, but it is something towards your future career. An apprentice who behaves himself and learns his trade shall find future employment with the White Star Line, so far as may be possible, either on the ships or on shore. In Mr. Willett Bruce, Mr. Boumphrey and Mr. Ormston you have three principals who take an interest in your welfare, and look forward to your serving the White Star flag as it should be served."

Mr. Willett Bruce : "I would like to say there is no doubt that it will give me very great pleasure to retain any of our works apprentices, and especially the prize-winners. I have been looking over the list of engineers in this service, embracing between 350 and 400, afloat and ashore, and out of the thirty steamers comprising the fleet, I find that six of the chief engineers were apprentice boys who served their time at these very works under my supervision, are now serving under the time-honoured White Star flag in this important position. I trust you boys will endeavour in the future to follow in their footsteps."

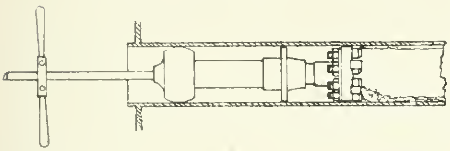
The Iron and Steel Institute.—The annual general meeting of the Iron and Steel Institute will be held, by kind permission, at the Institution of Civil Engineers, Great George Street, London, S.W., on Thursday and Friday, May 14th and 15th, 1908. The annual dinner will be held—under the presidency of Sir Hugh Bell, Bart.—in the Grand Hall of the Hotel Cecil, on Thursday, May 14th. The autumn meeting will be held in Middlesbrough on September 29th and following days.

THE RATCLIFFE IMPROVED DIRECT-ACTING TUBE-SCALING TOOL.

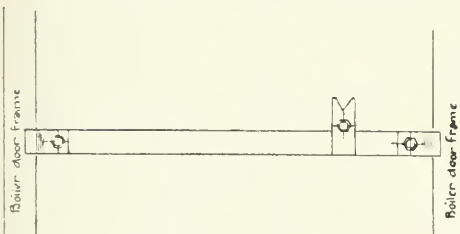
Those who have had experience with water-tube boilers or economizers in which hard water has to be used know full well the loss in efficiency which occurs when the tubes become coated with deposit, and the difficulty with which the deposit can be removed. The labour involved is usually considerable, the cost high, and the work when completed leaves much to be desired.

We illustrate in the adjoining diagram a new type of tool which has been designed for the purpose, and is an extension of the use of pneumatically-driven tools in a most desirable direction. The tool itself

Details of the "Ratcliffe" Tube Scaling Tool.



Showing Section of Tube being cleaned.



Cross Bar & adjustable V guide.

consists of a series of small cutters fitted into a circular block, the spindle of which is operated by a pneumatic hammer. The cutting edges of the tool are so arranged as to strike direct on to the scale to be removed, thus making the tool positive in action, as it cannot pass through the tube without removing all obstruction. It is pointed out that the sides of the tubes cannot in any way be damaged by the cutting edges, as they do not come in contact with the tube, nevertheless the tube will be left perfectly clear and free from scale.

The device is adapted to be controlled by one operator by means of a throttle valve on the air supply, fitted at the end of the guide pipe. An adjustable handle is screwed on to the guide-pipe at a suitable distance from the guide-block for the tool to be manipulated without undue strain, and by which the machine can be rotated through an arc of about 90° whilst the cutters are in motion.

Before inserting the tool into the tube the end of the latter is cleared of all scale for about 6 ins. to freely admit the cutters. A guide bar, such as is illustrated, is fixed up in front of the tubes, and carries a V block, in which the guide-pipe rests, in order to maintain the tool axially in the tube. The throttle-valve is then opened, admitting air, when the tool will be operated until the entire length of the guide-pipe has entered the tube, when another piece of guide-pipe can be coupled up, and so on, until the whole of the tube has been cleared of scale. The exhaust air from the hammers is directed forward, so as to clear the broken scale from the cutters; but this is not sufficiently powerful to remove large pieces, to do which the tool can be withdrawn and the tube cleared with a wire-brush.

In actual work one of these cutters has removed scale $\frac{3}{4}$ in. thick from a 4-in. tube, at the rate of 3 inches per minute.

These tools are put on the market by Messrs. John Miles & Co., Ltd., of Hawley's Wharf, Brentford, Middlesex.

The different plans adopted throughout the country for the encouragement of apprentices serve to show that the leaders of our industrial enterprises are anxious to do their part towards the growing generations and facilitate the training of those entrusted to them in respect to both the practice and theory of mechanics and engineering. It is a pity that, with all the opportunities placed before them, so small a percentage of the apprentices take advantage of them. There are three lines which ought to converge to bring about the desired result in a steady line of improvement; the difficulty is to get all the lines at the point of union. That which lags most appears to be, from reports and comments received from statistics given in technical papers and from personal observation the line which one would expect to be the most in evidence in the forward movement—the line representing the apprentice himself. The other two lines represent the parent or guardian and the employer. We have no means of knowing what part the former takes in encouraging the youth to improve himself in the technic of the business by which he is to earn his livelihood, but we do know what the employer is doing, and that the line representing him is well in advance. In a very good plan operating at one establishment there is provision for the awarding of marks, part for the workshop conduct and part for the technical classes, and, depending on the gaining of certain percentages, there is an increase of pay of 1s. per week or 6d. per week, according to the results. It has been said on more than one occasion in our hearing that the educated lad is not so amenable to learn the practical work and has not the same interest in the material he has to put together. We cannot endorse this view, except on the premises that the so-called educated lad is not educated in the true sense. Education is for the purpose of enabling a lad to make the best possible use of the faculties, whether mental or physical, with which he is endowed and in the particular station in life in which he finds himself placed, knowing that attention to the duties of the day and being amenable to those in authority over him are two elements which will combine in fitting him for a higher grade. Any system of education which tends to priggishness and to elevate the nose instead of the dignity of labour and the duties of the day fails in its important function.

INSTITUTE OF MARINE ENGINEERS.

At three of the meetings of the Institute of Marine Engineers during February, presided over by Mr. Alex. Boyle (vice-president), lectures on copper and copper pipes were delivered by Mr. J. T. Milton (member), engineer-in-chief Lloyd's Registry. The manufacture of copper was dealt with; the process of smelting and casting into slabs for general use, and that of electro depositing for more specific use were explained. Copper being ductile was valuable for making steam-pipes, lending itself readily to changes of of form. While most valuable for electrical work in its purest state, owing to its higher conductivity, it had been found that the elements eliminated in trying to raise the standard of purity were useful for many other purposes when retained in the manufactured copper. The presence of bismuth, however, was detrimental, and for steam-pipes essentially so, as it had the effect of hardening the material at high temperatures. That comparative freedom from rust and corrosion in it rendered copper useful for a variety of services. Cases of corrosion were, however, not uncommon, and in many the causes were obscure. With regard to so-called impurities, the most recent Admiralty standard allowed ·7 per cent., as it had been recognised that the higher standard excluded the better material for general purposes. Arsenic and other elements were good impurities to have; emphasis was laid on the "poling" of the molten copper in process of manufacture. The slabs for sheets were first rolled hot; further rolling into the various thicknesses was done cold. The amount of work put upon the material improved the quality, giving it a closer grain. The seamless, built-up and the electro-depositing processes for the making of pipes were described and the advantages and disadvantages of each considered. The last-named had not proved suitable for the purpose of steam-pipes. It was not good practice to test pipes without annealing them, such being no determination of depreciation in quality. At the conclusion of the lecture a brief discussion ensued, when Mr. A. Brown expressed his opinion that the inclusion of some of the so-called impurities by the electro-depositing process was necessary for good copper pipes. The oxygen gas now used for brazing pipes was an improvement over old methods. Mr. Geo. Adams considered that larger steamers involved larger pipes, which could only be made by hand, and thus the skill of the craftsman was as important as ever in working the copper. He held that steam-pipes should be annealed periodically. The money market might affect the quality of copper. Corrosion of pipes was a matter which required investigation. Mr. McNaught said deposited copper was valuable for lining hydraulic rams and similar work, while for calico-printing rollers great economy had been affected by its use. Mr. W. McLaren asked if tests had proved whether quenching or slow cooling were the better method in annealing; also Mr. Britton who further asked why planished pipes were less suitable for steam than exhaust pipes. Mr. Tidman advocated annealing, as did Mr. D. Hulme, who at the same time said that in course of annealing and testing pipes with bends they sometimes were distorted. Mr. Grisdale commended annealing, and said the strength of the copper was increased by compressing the grain. Mr. Milton, in reply approved of oxygen gas for brazing, and the annealing of pipes, but had refrained from recommending it unless it was done properly. He proposed to refer to corrosion on February 10th. High prices, in his opinion, did not affect the quality of the copper. Planishing made the copper less ductile and less able to stand vibration, which was more apparent in steam than exhaust pipes; there was also the internal pressure in the former, while in the exhaust there was less danger. There was little difference made by quenching with water or allowing the metal to cool down in annealing. The distortion in shape when annealing was probably due to the pipe not being quite circular. The gain in strength by compressing the grain he had already emphasized in speaking of putting work upon the copper.

A vote of thanks moved by Mr. John Clark, and seconded by Mr. J. F. Elmslie was accorded to Mr. Milton and to the chairman on the motion of Mr. K. Balfour seconded by Mr. J. J. Aukland.

Treating of the design of steam pipes in the second lecture Mr. Milton said that provision should be made so that there might be no accumulation of water, by avoiding drops in the line from the boilers, it was also important to allow for the expansion of the pipes, which, in the case of copper, was about ⅛ in. per 3 feet when heated to a temperature of 380° F.; They should be properly "anchored" and carefully fixed to leave room for expansion. Bends in a pipe did not necessarily give it flexibility, as the flexibility was proportional to the area of pipe involved between the points of fixture. Annealed copper was practically elastic up to the stress limit. Ordinary copper was annealed to a very slight extent at a temperature of about 400°F., but at a bright red or brazing temperature it took place immediately and thoroughly, while the pure copper formed by electrical deposition annealed very rapidly at 200°C. One probable reason of steam pipes failing when made by this process was that pipes with the bends could not be uniformly annealed over the ordinary coppersmith's fire, added to which it ran the risk of being "gassed" or de-oxidized on the surface, resulting in the formation of small cracks. The pipes should be heated in a special furnace to secure uniform annealing. Brazing depended to a very great extent upon the skill of the workman. He did not think the practice of making a high collar in brazing flanges was advisable. Brazed steam pipes or pipes with brazed flanges were not suitable for superheated steam on account of the deteriorating effect of the heat upon the brazing metal, as if left too long over the fire some of the copper would dissolve and combine with it. Samples of copper were exhibited showing the effects of various tests, and illustrating the effects of gassing and of corrosion. Mr. Tomlinson said that in an experiment he had subjected ordinary "tough" copper to a temperature of 300 to 400°F., and kept it at that for a very long period without resulting in its being annealed in the slightest. In a prolonged heat test at 1600°F. for four hours the "tough" copper lost 6 per cent. and pure electrolytic copper 4 per cent. tensile strength, while in the case of a 400° test the loss was greater in the pure than in the "tough" copper. He could give no general explanation of the cause of corrosion, as it varied with the conditions governing each case. Mr. J. Grisdale said in his experience copper pipes caused little trouble if room were allowed for expansion. He thought the amount of repairs to copper work was very small in proportion to the repairs necessary in other parts of the ship, due to the great advances made in recent years in the making. A high collar on a flange was, in his opinion, sometimes advisable. Mr. Robt. Balfour expressed the opinion that the corrosion, especially in injection pipes, was due to the effect of air, as it occurred on the upper surfaces of pipes partly filled with water and not at all when the pipe was kept quite full. Mr. Geo. Adams commented on the spring hanger method of supporting pipes as a means of providing for expansion. Defective pipes were often undetected in testing by the flange joint being placed over a seam where the brazing was not holding. He thought electro-deposited copper on the inside casings of centrifugal pumps might prevent the corrosion often found there. It was difficult to give a reason for corrosion in copper pipes as the effects were so arbitrary, different results being observed when the conditions were exactly similar. Mr. F. M. Timpson spoke as to the efficacy of spring hangers. He thought a spigot joint would counteract any defect in the flange brazing. Mr. W. McLaren considered that a good deal of trouble would be obviated if in the pipe design more attention were paid to a good "anchorage." He agreed that air was responsible for much of the pitting action. The proceedings closed with votes of thanks to Mr. Milton and the chairman.

The discussion was resumed at 58, Romford Road, Stratford, on Monday, February 17th. Mr. D. McNaught asked what was the best method of casting the copper in order to get a sound casting, and referred to another method of flanging copper pipes without brazing them. Mr. W. F. Farenden asked what was the best temperature for annealing, and whether quenching was preferable to allowing the metal to cool down. Mr. Milton said there was a difficulty in obtaining sound copper castings as with other metals. In one process the copper was subjected to hydraulic pressure while in a fluid condition to prevent the formation of blow-holes. There was no difficulty in making a copper-zinc casting perfectly sound but it was very rare to find gun-metal castings free from defects. The type of flange referred

to was the Pope flange, in which the ends of the pipes were turned out all round to form a collar, thus making a metal joint and secured by means of heavy wrought-iron flanges. The purer the copper the lower the temperature at which it would be annealed, and the higher the temperature the quicker would the annealing be performed. At a bright red the annealing took place quickly, but the temperature and time taken depended to some extent on the class of copper. Mr. Allen (Messrs. Hawthorn, Leslie & Co.), in making tests in connection with the cooling of copper when annealing, had found that the results were slightly in favour of quenching. From other tests the effects of "gassing" were found to be very serious. Engineers should refuse pipes in which "gassing" appeared on the surface, as it was only a question of time before the cracks would extend. Gassing was caused by heating the copper to a red heat in a reducing flame, which absorbed the oxygen from the surface of the copper. It was difficult to determine the cause of corrosion in copper pipes as the action took place so slowly. It might be due to the action of air escaping from the water when the pressure was reduced, as in a partly-filled pipe. When copper was cast, the particles cooling out first were the purer when impurities were present in the metal, hence it was not perfectly homogeneous. The purer the copper the greater its conductivity, and this was a probable reason for the sporadic nature of the corrosion in some instances. Mr. Brown thought that many of the defects in copper pipes were due to faulty design, and he instanced a case where a 13 ft. main steam-pipe was provided with flanges only ⅞ in. thick, resulting in troubles which were obviated when the thickness of the flange was doubled. There were cases where the pipes became stays due to bad design. He considered good expansion bends were much better than joints. In steam-winch iron exhaust pipes corrosion went on rapidly, necessitating constant renewal, and he thought copper pipes would be cheaper in the end and more suitable for this purpose. Mr. J. Thom considered the average expansion joint to be suitable if the anchorage was good. He believed a good deal of the decomposition in copper was due to the electrical arrangements in steamers. Mr. G. W., Newall suggested that the Toredo beetle, which damaged the Atlantic cables, might have something to do with the wasting of copper in presence of sea-water. Mr. Milton said the damage done by the Toredo was due to it boring through the insulation, thus allowing sea-water to get at the copper. A serious disadvantage of the spirally-bent pipe for expansion was that, unless it was nearly vertical, it formed a water trap. Mr. J. Grisdale preferred semi-circular bend rather than the rectangular form with bends of smaller radii, as the work was more equally distributed. It should be compulsory to have escape valves fitted wherever a dip occurred with a rise to form a well. Mr. N. K. MacLean had overcome the action of corrosion at the bend of a large discharge pipe by means of coating it with a preparation called "Asphaltum." It was explained to him by a chemist that the corrosion was due to a gas given off by the salt-water when heated to a certain temperature.

It was decided to resume the discussion on Mr. Milton's lectures on Monday, March 16th. The proceedings then closed.

ELECTRICAL NOTES.

(From our Own Correspondent.)

Dynamo and Motor Design.

THE design of these machines has become pretty much of a type pattern, but it is as well to note there are peculiarities by some makers, and one of these is known as the Zone system, a maker of which is Newtons, Ltd., of Taunton. In this case the usual method of spacing solid-wound poles in the field-casing round the armature is abandoned in favour of a spool which embraces a pair of poles, an air-tight gap being between. The construction allows the machine to be run with fixed brushes at all loads from no load to 50 per cent. overload. It is claimed there is an increased efficiency and a greater cooling effect due to the peculiar disposition of the field winding. There is certainly air both inside and outside the windings which would have the effect named. A further claim is that the special windings dispense with the need for commutating poles. Both dynamos and motors carry these features, and the machines can be wound shunt series or compound. The design is unique and appears of considerable value.

Motor Erection, etc.

This matter is considered simple, but nevertheless mistakes may be made. The best plan is perhaps to bolt the motor to the slide rails, the position of which should be such that the maximum amount of belt adjustment can be obtained. The whole then has to be lifted on to its bed, which may be stone or concrete or even timbers fixed to the floor. Following the pulley on the motor is lined up to that it has to drive. The motor will not as a rule stand directly under the pulley it has to drive, and a string is stretched from the centres of the pulleys. The motor is then levelled by placing a spirit level on the surface of the rails and forcing packing under the rails until the motor is level. This finished, connecting up follows, and if a shunt-wound motor, one end of the field winding is connected direct to one of the brushes and the other to the starter field contact. This lead is usually thinner than the other two, and therefore readily distinglished, with double pole switch fixed, fuses and starting resistance; the next lead goes straight to the main switch terminals. The other thick wire goes to one of the large terminals on the starter; this terminal is generally marked armature. The thin wire is connected to small terminal marked shunt or field. The remaining terminal on the starting resistance switch is then connected to the main switch, when all is then complete.

Motor Starter.

A drawback to motor-starting switches is that by suddenly throwing over the starting arm the full voltage of the circuit can be applied to the motor, thereby damaging both that and the starting apparatus. To avoid this, ratchet starters have been introduced by which the motor can only be started slowly, as the travel of the operating handle is limited and only advances the starter arm a definite distance. The arrangement consists of two levers, one for the ratchet motion and the other for cutting out the armature resistance, the latter being returned to the "off" position by a powerful spring. Engagement is made with the starting lever by a pawl and catch by which the lever may only be gradually advanced, and should the voltage fail or an overload come on the motor the coil is short-circuited and the starter arm flies quickly back. The action is described as quite effectual in service, the makers being Messrs. Bray, Markham & Reiss, of Walthamstow.

Electric Heater.

A contrivance introduced in the States for heat-radiating purposes is to employ electricity so that the water itself is the conductor, and there is an entire absence of all wire or other resistance. The current taken from an ordinary 110 volt or 220 volt lighting circuit flows through the water from one carbon electrode to the other of these two electrodes; one is solid and the other hollow with air-intervening gap of about a quarter inch, through which the water comes from the mains, an efficiency of 99 per cent. being claimed. The casing is cast iron and the wiring connections are well insulated from the case and connected to their respective carbon electrodes. The heater is made in various sizes, from 4 ampères at 110 volts to 20 ampères at 220 volts.

Wireless Telegraphy.

At a recently constructed Marconi station for Trans-atlantic telegraphy four towers 215 feet high have poles 50 ft. high and the aerials, about fifty, run in a westerly direction horizontally for several hundred feet. The plant comprises 500 H.P. engine with 350 k.w. three-phase alternating at 2,000 volts. It is said that only 70 watts is used for transmission with very strong power to prevent atmospheric disturbance. According to reports, Poulsen's system is making headway, and he is said to write the messages automatically. The inventor claims that this enables him to compete with the cables, his speed being given as 22 words per minute. At an installation during some yacht races in America reporting was accomplished at 15 miles' distance by the Stone system at the rate of 24 words per minute from flat poles 25 feet high. Ashore the mast was 50 feet high, and horizontal antennæ were used in each case. Though other signalling was going on, there was, it is said, owing to the high degree of selectivity in this system, no interruption whatever during the progress of the races, though Portsmouth Navy Yard was close at hand.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

New Orient and Other Liners.—Whether it is due to a desire to spread the construction of the vessels over as many firms as possible, in order to expedite the work, or, as has freely been rumoured, it is on account of the disinclination among builders to accept the terms proferred by the owners, the fact remains that there has been great delay by the Orient Company in actually placing the orders for the five or six steamers which they must build under the terms of the contract for the Australian mail service. During the past month, or over, repeated reports as to the fixing of the contracts have been made, the destination of individual vessels being variously stated, but Clyde firms have always had prominent mention therein. There is still, at the moment of writing, dubiety over the definite destiny of the work, but the latest report as to the placing of the contracts is that the London and Glasgow Company, Govan; the Fairfield Company, Govan; Messrs. John Brown & Co., Clydebank, and Workman, Clark & Co., of Belfast, have each received an order for one vessel at least, but in the case of one or other of the firms named there will be two vessels to construct. In the case of the Clydebank firm it has been reported that an order for two of these vessels has been received, and for a smaller vessel, said to be for the Great Eastern Railway Co. Since the completion of the *Lusitania*, and the launch of the cruiser of the *Invincible* class, the large Clydebank establishment has been very badly off for fresh work. For their engine department the Company have also booked an order for the engines to be fitted in a Russian war vessel now under construction in Russia. For prospective work in the way of ocean steamers of the intermediate class the Clydebank and other firms have sent, or are about to send, in tenders. Of such work offering, and of which Clyde builders may likely have at least a share, reference may simply be made to several intermediate vessels which the Cunard Company, the Canadian Pacific Company, and the Union Castle Company are said to be in want of, although negotiations are meanwhile hung up. The two 18-knot turbine steamers which the Austrian-Lloyd Co. require for service between Trieste and Alexandria are still in the market. Both Clyde and English builders have sent in tenders for these vessels, but the specifications and plans are still subjects of consideration, and tenders for modified designs are again being asked for. Although prices may probably be still too high for the Austrian Co. to decide, the business is bound to materialize before very long, and there is good reason to believe that one or two Clyde firms experienced in turbine work, and who have already built for the Austrian-Lloyd, are well in the running for the contracts. The Donaldson Line of Glasgow are now considering tenders for the construction of a steamer like the *Cassandra*, which was built by Scott's Co. at Greenock some time ago. The New Zealand Shipping Co. are considering prices for a 2000-ton coal-carrying vessel like that which was built at Port Glasgow some time ago by Mr. D. J. Dunlop. The Anglo-American Oil Co. are enquiring for some vessels of about 160 ft. keel, for the bulk oil carrying trade. The London and South-Western Railway Co. are considering prices for two passenger steamers of 170 ft. length, somewhat like the *Princess Ena*, which was built not long ago by Messrs. Gourlay Bros. & Co., of Dundee.

New Orders Placed. The Clyde Shipbuilding and Engineering Co. Port Glasgow, have been commissioned by Messrs. McIlwraith McEachearn & Co. to build and engine a coal carrying steamer to be employed on the Australian coast in connection with the work of the Bellambia Coal Co., Ltd. Sydney. The vessel is to be delivered in May. Messrs. Hutson & Sons, Ltd., Kelvinhaugh, have secured the contract for the building of a new fast paddle passenger steamer for English owners. The vessel has to be 200 ft. in length, 24 ft. in breadth, and 7 ft. 6 in. in depth (moulded). It is to be ready for delivery by the end of June. The Ailsa Shipbuilding Co. of Troon and Ayr, are to build for the Southampton, Isle of Wight and South of England Royal Mail Steam Packet Co., Southampton, an addition to their fleet of steamers. Motor boats, using petrol for fuel, continue to grow in popularity with Clyde yachtsmen, and orders for a number of vessels have lately been placed. Messrs. Paul, Jones, Sons & Co., Gourock, are to build for local owners two 28 ft. cabin launches, both of which will be equipped with petrol engines. The Bergius Launch and Engine Co., Glasgow, are fitting a 35-ton yawl with auxiliary motor power in the form of a 14 h.p. Kelvin four-cylinder paraffin engine, driving a Bergius patent folding propeller placed under the port quarter, about 18 in. off the centre of the boat. It is claimed for the Bergius system of installation that the propeller acts in undisturbed water, and gives a better return in speed than a propeller fitted in the deadwood. Auxiliary machinery consisting of a 9 h.p. Kelvin petrol motor, driving a Bergius patent folding propeller, is also being fitted to the cruiser *Wyona* of 28½ ft. length of load-line, building in the yard of Mr. Yate at Clynder. The installation will be fitted on the same lines as above referred to, namely, the propeller shaft will be brought through the vessel's side some little distance off the centre-line. The engine itself will be so arranged and placed as not to interfere in any way with the cabin arrangement. Messrs. McLaren Bros., Dumbarton, have received an order for a 25 ft. passenger launch for use in connection with one of the West Highland hotels. She is to be fitted with an 8-h.p. "Scout" motor and McLaren reversible propeller, which will give her a speed of something like 9 knots. The same Dumbarton firm are to build for Mr. William Blyth, of Largs, a 23-ft. launch to be used for passenger traffic at the Ayrshire watering-place. She will be fitted with a 4-h.p. "Scout" engine and McLaren reversible propeller. For Mr. James Gillespie, of Rothesay, a Millport firm are building a launch which will be equipped with an 8-12 h.p. double cylinder "Fairbank" motor, complete with reversible clutch equipment. Mr. Percy Lowcock, agent for the Gardner paraffin engines, is supplying a 10 h.p. paraffin motor to Mr. Wilson, boat hirer, Port Bannatyne, which will be fitted on board the launch, which has plied for hire during the last two seasons.

Naval Work.—With the beginning of February it was intimated that the Admiralty had placed with Messrs. William Beardmore & Co., Parkhead Forge, orders for 2500 tons of armour plate, amounting in value to a quarter of a million sterling, for the three battleships now building in two of the Royal dockyards and at Barrow-in-Furness. Work has since been resumed in the armour-plate department, and a large number of workmen who had to be discharged were promptly given employment. The orders received involve the starting, not only of the armour-plate rolling mills, but also of the large armour-plate machine shops. Another Admiralty commission, of less importance as contributing to increased employment of workmen, but of very vital interest to those shipbuilding firms on the Clyde who have long considered it strange that they should not be asked to share in a class of work for which their establishments and their experience eminently fit them for undertaking, is the order for a torpedo boat destroyer of the 33-knot ocean-going class, of which five at this time have been given out. The Clyde firm thus requisitioned is that of William Denny & Brothers, Dumbarton, who have at present two destroyers of the coastal type on the stocks, and one in the middle of her series of speed trials. Although torpedo boat destroyers some years ago were produced in considerable numbers for both British and foreign navies by other Clyde builders—the Clydebank Shipbuilding Co. and Messrs. Hannah, Donald & Wilson, for example—this class of work is being taken up for the first time by the renowned Dumbarton firm. Their reputation for the production of high-speed Channel steamers—paddle, twin-screw and turbine—and the very special scientific facilities and experience they possess in the way of speed trial results, and trials with models in their experimental tank department, are considerations which place them advantageously for success in the high-speed lighter class of naval vessels. It is confidently expected that the results from the vessels now undergoing trial and about to be launched will bear out this contention. The fact of the Skelmorlie "measured mile" being so favourably regarded by our own and other naval authorities as a standard arena for speed trials is another factor in the case for Clyde builders sharing more in this class of work for the future than they have done in the past. The adjacency of the "measured mile" was also one of the considerations

which weighed with Messrs. Yarrow & Co. in transferring their whole establishment to Clydeside. This company, as is pretty generally known, have at present on their books orders for no fewer than ten torpedo boat destroyers for the Brazilian Navy. The first unit in this fleet of destroyers is now nearing completion on the stocks, and is intended to be launched about the latter end of next month or early in April. Other three of these vessels, which are on the stocks alongside, in proportionate stages of construction, will be launched in due rotation, and the berths vacated will in turn be taken up with other vessels of the same large contract.

New Torpedo Factory.—The Admiralty have now informed the Greenock Corporation that negotiations have been completed for the purchase of Battery Park in that town for the purpose of erecting a torpedo factory. The erection of the buildings will be proceeded with immediately, and these, it is stated, will be designed so as to give the minimum of inconvenience to the residents and harmonize as far as possible with the surroundings.

New Shipyard Cranes.—Applebys, Ltd., of Glasgow, Leicester and London, have been commissioned by Messrs. Vickers, Sons & Maxim, of Barrow-in-Furness, to equip with the crane structure and steam machinery a floating crane pontoon which that firm are building for the harbour authorities of Montreal. The crane will be of 75-ton capacity and will be self-propelling. Applebys, Ltd., are at the present time erecting on the structure covering in the fitting-out basin of Messrs. Yarrow & Co. at Scotstoun—of which an illustration was given in our account of that Company's works in our January issue—a 50-ton overhead travelling crane which has a span of 93 ft. This, it is believed, is one of the largest span overhead cranes of such capacity yet erected in this country. While 50 tons is the working load on the heavy hoist of the crane, there is an auxiliary hoist designed to deal with loads up to 10 tons. Four motions are thus necessary, each working by a separate motor, namely, lifting heavy loads, auxiliary lifting, longitudinal travel and cross traverse, the lifting and the travelling motors being of 50 h.p. The following are the approximate speeds attainable with these motors:—Lifting heavy hoist, full load, about 10 ft. per minute; lifting auxiliary hoist, full load, about 30 ft. per minute; travelling, full load, about 500 ft. per minute, and traversing, full load, about 125 ft. per minute. The whole crane weighs about 58 tons, and is provided with a platform on each side running the whole length of the girders. Two overhead cranes of the same capacity and somewhat similar in design, but of only 62 ft. span, have been fitted by Applebys, Ltd., in the Yarrow shops, one in the engineering shop and the other in the boiler department, and the boiler shop crane is operated from the floor by pendant ropes. Both these cranes were illustrated in the article descriptive of Messrs. Yarrow's works above alluded to. It may be added that the unfortunate accident during a strong gale to the overhead crane of Applebys' providing on the building berth equipment in the yard of Messrs. Beardmore & Co., Dalmuir, has now practically been rectified. This crane and the berth equipment were illustrated in our January issue.

New Docks and Wharves.—The extensive new docks which the North British Railway Company have decided to have constructed at Methil, Fifeshire, are to be built by Messrs. Robert McAlpine & Sons, Glasgow. It is computed that it will take three years to execute this important contract, which will involve a monetary expenditure of quite a half a million sterling. The Dundee Harbour Trust through their engineer, Mr. J. H. Thompson, M.Inst., C.E., are taking in offers for the reconstruction of a further section of the Eastern Wharf adjoining the present section built, of ferro-concrete on the Hennibique system, two years ago. The reconstruction of this new section, which will be 310 ft. in length, can be effected without interfering with shipping, and will involve an expenditure of about £11,000.

Dredger-Building.—For the improvement of Heysham Harbour and to the order of the Midland Railway Co., Wm. Simons & Co., Ltd., launched on February 8th a grab hopper dredger named *H ssa n*, which is classed at Lloyd's and fitted with three of Priestman's cranes and grabs, capable of dredging about 500 tons per hour, and to a depth of 48 ft. below water level. The propelling machinery consists of compound-condensing surface engines and two steel boilers of sufficient power to obtain a speed of 10 knots per hour. The hopper doors are controlled by steam winches, and steam winches are provided at bow and stern for manœuvring the vessel when at work.

Appointments for Clyde Engineers.—During February at least two gentlemen of position in the engineering world of Clydeside have been enlisted into the service of bodies away from the district. At a meeting of the directors of Cammell Laird & Co., held in London on February 12th, Mr. Arthur Daulby Wedgwood, late of the Dennystown Forge Co., Dumbarton, was appointed managing director, while at the same time Mr. Henry Edward Deadman, C.E., late of the Admiralty, and Major Arthur Handle, late R.A., were elected directors. The other transference alluded to is that of a Paisley engineer being draughted to the Thames. Mr. R. J. N. Wilcox, who has been general manager for Messrs. Fleming & Ferguson, Ltd., Paisley, for the last five years, has been appointed marine engineering superintendent to the Thames Conservancy Board at a salary of £500 per annum, rising by annual increment to a maximum of £700. Doubtless the technical ability of Mr. Wilcox, and the experience gained in the work of designing and constructing dredging and other associated vessels while with the well-known Paisley builders, will splendidly fit him for the responsible charge of the Thames Conservancy Board's increased, and increasing, dredging property.

THE TYNE.

(*From our Own Correspondent.*)

A Struggle for Supremacy.—In the recollection of the very oldest observer no such conflict between capital and labour has arisen in this district as that which is now apparently close upon us. As a defensive measure the shipbuilding employers have had to resort to lock-out notices, and the ship-repairing firms have followed suit. The lock-out was decided upon because the joiners and shipwrights and one or two minor sections refused to acquiesce in the wages reduction, which the boilermakers and labourers had agreed to. A conference between the employers and the workmen's representatives took place on the 14th inst., and before breaking up the employers intimated that they would be willing to confer again with the representatives, provided the latter would come with full power from their constituents to arrange terms of settlement. The latest development now is that the men are not willing to give, nor the leaders to acquire, power to settle, and it is therefore probable that even should a conference take place this week, the whole of the shipyards and repairing establishments will be closed on Saturday. The leaders indeed have now abandoned all pretensions to conciliation, and openly declare that the employers will have to "fight this matter out with the men." They must be regarded as poor leaders indeed who thus propose to relinquish their authority in a time of stress, and it would seem that leaders of this type might very well be left out of account. These so-called leaders are damaging the cause of trade unionism more seriously than they imagine. One of the points which years ago helped to remove the prejudice against trade unions that existed among employers was the circumstance that in case of a dispute they would not have to deal with an irresponsible crowd, but would be in a position to discuss any matters of difference that might arise with representatives who, presumably, would be men endowed with some degree of judgment and discretion. It was well known that trade unions were objectionable from several points of view; but in consideration of the one advantage referred to, many employers who did not like being tied down to "conditions" in carrying on their business, waived their objections, and even went so far as to foster the growth of certain unions. The possibility of coming to terms with representatives, which at one time existed, is now not even thought of—all that occurs at a conference is an interchange of views, and a final arrangement to put the employers' proposals (whatever they may be) before the men to be voted upon. So that the employers have to deal with the crowd after all, and are having it forced upon them more strongly every day that what is done at conferences might just as well be done by correspondence. The employers, it should be stated, always attend these conferences with full power to settle on behalf of their absent colleagues. It follows that workmen's representatives should be equally armed with authority, and if this were so

much ill-feeling and much serious damage to trade would be avoided.

The Engineers' Decision.—The members of the engineers' societies on the North-East Coast have been balloting on the employers' proposal for a wages reduction of 2½ per cent. on piece prices and 1s. per week on time wages. The original demand was for double that amount, but after repeated "conferences" the employers modified their proposal to the extent indicated. The result of the ballot, however, which has just been made known, was to refuse the acceptance of even this insignificant reduction, and to decide upon coming out on strike. This decision, which at the time of writing is being acted upon, complicates the situation most seriously. Marine engineering and shipbuilding are, as every one knows practically one industry, and are equally affected by trade fluctuations. It was, therefore, not surprising that wages reductions should be sought for simultaneously in both branches of business. The shipbuilders' claim, however, was made a little in advance of the engineering employers' claim, and would have been decided a month ago were it not for the refractory behaviour of the shipwrights and joiners, who, though in a minority, refused to fall into line with the larger bodies, who had come to an agreement with the employers. Had the shipbuilding dispute been settled, that circumstance would, no doubt, have its effect on the engineering trouble, and that effect would most assuredly be in the direction of peace. The two sections mentioned are, therefore, to a large extent responsible for all the trouble that has arisen, and possibly for further trouble to come. These men, who appear by their bellicose attitude, to have been "spoiling for a fight," may have their fill of fighting before all is over, and may live to rue the unreasoning spirit they are now displaying. The old adage about "killing the goose that lays the golden eggs" was never so strongly exemplified as it is in the present crisis. Both leaders and men in this struggle appear to forget that there is such a thing as foreign competition; but they may receive a rude awakening when they find that work is being diverted from this to other countries that are only too ready to receive it. Let them not deceive themselves with the notion that the foreigners cannot do the work—why, even far Japan has half a dozen shipbuilding and engineering concerns going, one of which turned out last year two "turbine"-engined vessels of the largest class, and a triple-expansion engined vessel of nearly 9000 tons capacity. They will learn, perhaps, sooner than they imagine that England is not the sole shipbuilding country of the world now, and that it behoves them to restrain their fighting ardour if they want to have any work for themselves a year or two hence. What is here stated applies equally to the shipbuilding sections on strike, and to the engineers who are commencing a strike, for the latter appear to be quite as pugnacious as the former, they having voted for a strike by a majority of five to one. In all this commotion made by mechanics the interests of the labourers are entirely ignored. Anyone would think that, in a time of such terrible distress as now exists, men of humane instincts would pause before entering on a course that must immeasurably increase the distress. But they do not pause—they appear determined to go on in their own wild way, no matter what may happen to those weaker than themselves. And this is the spirit of modern trade unionism; it certainly contrasts very unfavourably with the employers' action in exempting from the proposed reduction all men rated at 24s. per week and under.

THE WEAR.

(From our Own Correspondent.)

The Stoppage at Messrs. Laing's—The suspension of payment by the long established and highly respected firm of Sir James Laing & Sons became known on the 10th inst., and caused a shock which by no means was confined to this locality. That the firm which built and equipped the *Cyclops*, and modernized their yard to such an extent that, as a shipbuilding concern, it has few equals in the kingdom, should come to a standstill so unexpectedly, was enough to upset many optimistic calculations, and should prove an object lesson to those who are so ready to strike against a small wages reduction on the ground that shipbuilding firms' profits are "enormous." It shows that all is not plain sailing even with the strongest firms, and that in asking to be assisted in providing work by a wages reduction, employers are not so "grasping" as they are often represented to be. The Electric Committee of the Sunderland Corporation only last week stopped the supply of electricity, and the Water Company stopped the supply of water; but, notwithstanding these difficulties, the firm found means to keep a considerable part of the machinery going until the 18th inst. A notice was on that date posted stating that the yard was temporarily closed; but that the stoppage would not be greatly prolonged. A liquidator has been appointed, and in a letter to the creditors that gentleman states that he proposes to carry on the business so far as is necessary to complete the work in hand.

Prospects at Other Yards.—It is stated that Messrs. Doxford have recently secured some orders, but the statement requires confirmation. There is also a rumour of an order being placed by a Liverpool firm with the proprietors of a Northside yard, but this also appears to be largely a matter of surmise. We note that Messrs. J. L. Thompson and Sons have a second vessel in the framing stage, but it is depressing to see three of the berths in this ordinarily busy establishment still lying vacant. There are two vessels under repair in the Wear Commissioners' graving docks, and Messrs. Austin have also some repair work in hand. It is said that the West Coast repairing yards are largely benefiting by the wages disturbances on the Tyne and Wear.

Engineering.—The state of business in the marine engine shops shows little change, and in the smaller works a further lessening of activity is noticeable. Ironfounders are having less work, and forges are worse off for orders than they have been for years.

At the eleventh hour the shipbuilding employers have withdrawn the lock-out notices so far as concerns the sections who have agreed to the reduction This decision was arrived at by the employers at their meeting on the 21st inst. No settlement has been effected with the shipwrights and joiners who are on strike resisting the reduction Instead of withdrawing the claim for a reduction as the strikers demanded, the employers have intimated that they will now require the wages of shipwrights and joiners on the N E. coast to be the same as are paid on the Clyde. This, of course, widens the breach, but the men have themselves to blame, as hitherto they have proved intractable. The President of the Board of Trade has intervened in the engineering dispute, with the view of trying to bring about a settlement, but nothing definite has yet been done Meanwhile the strike area extends, and it is understood that the number of men now involved is not less than 10,000

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

The Manchester Ship Canal.—The 45th ordinary meeting of the shareholders of the Ship Canal on the 13th February was a record attendance and altogether a joyful gathering. Despite the dearer prices of coal and increased wages of employés, the revenue receipts amounted to £287,251 and the expenditure to £141,106, leaving a working profit of £146,145. The working profit of the Bridgewater Canal was £15,556. The balance carried to net revenue account was therefore £161,701. After deducting £2,386, the debit on general interest on account, there was an available balance of £157,315, which was distributed as follows: Interest upon the first and second mortgage debentures, £44,742; interest upon the debenture stock, £3,500; interest upon the mortgage of surplus lands, £1,000; rent of transit shed and Dock No. 8, £3,130; rent of Dock No. 9 and transit sheds, £12,500; £93,975 to the Corporation of Manchester in payment of interest on the debentures they hold. The balance, £463, has been carried to the next half-year. The total amount paid to the Corporation in respect of the year 1907 was £160,000, being the full amount of the interest accrued due. The reserve fund account has been closed, the amount to credit having been appropriated in settlement of the Warrington litigation. The total seaborne and barge traffic during the last six months of 1907 was 2,806,967 tons; during the last six months of 1906 it was 2,457,788 tons.

Mr. Bythell, the chairman of the Ship Canal Co., said a spot cotton market in Manchester was imperatively needed. The directors of the Manchester Cotton Association realized

that need, and were about to take an important step in the hope of increasing the stocks of cotton and the business of ready cotton in Manchester. They were now getting for local consumption nearly as much Egyptian cotton as went to Liverpool, and he was confidently looking forward to increased support from spinners of Egyptian cotton.

The approximate revenue of the Manchester Ship Canal for January was £39 696, an increase of £1,492 as compared with the January returns of 1907. A fortnight ago the total bales of cotton from America this season numbered 255 125, and from Egypt 143,418 bales.

Nothing speaks so well as to the progress of the Canal as the fact that another new dock will be required in the near future. Mr. Bythell says it will require three years to construct. It would be necessary to get on with the work. It would not do to be unable to provide shipping accommodation for the increased trade looked for. The full amount of the dividend payable on the 3½ per cent. preference stock allotted to the Corporation would be £35,780, and whatever surplus there was after that belonged to the shareholders.

Manchester Chamber of Commerce.—Mr. Langdon, the chairman of the Manchester Chamber of Commerce, speaking at the annual meeting during the month, said he found that in 1906 no less than 45,980 lbs. of cotton yarn out of the total exports of 217,000,000 lbs. found their way to foreign parts by means of the Ship Canal. He had found that on shipments to the Continent there was, at that day's value, a saving of from ½ to ¼ per cent., which in a business as finely cut at that of Continental cotton yarn, was an item well worth considering. It was a matter for congratulation that the income had reached the expenditure, and that anticipations as to payment of interest had now been realised. Mr. J. K. Bythell, chairman of the directors of the Manchester Ship Canal, who was one of the speakers, said yarn was being conveyed to Germany through the Ship Canal at a reduction of 10s. per ton compared with the charges before the Canal was opened.' He appealed for further support for the steamers of the port.

The Public Health Act—The Public Health (Regulation of Food Act), 1907, is intended to strengthen the hands of the Local Government Board in the matter of preventing danger arising to public health from bad food. In addition to regulations made under the Public Health Act, 1896, regulations may be made authorising measures to be taken for the prevention of danger arising to public health from the importation, preparation, storage and distribution of articles of food and drink intended for sale for human consumption, and particularly to provide for the examination and taking of samples of any such articles and for the recovery of charges in respect of the regulations or any services performed thereunder. This is a very important enactment, and the regulations made by the Local Government Board thereunder will be interesting.

Manchester Steamship Owners.—At the annual dinner of the Manchester Steamship Owners Association during the month, Mr. R. R. Stoker, who presided, pointed out that although Manchester shipping was only in its teens, 120,000 gross tonnage was now registered at the port. Mr. E. H. Langdon, one of the speakers, suggested that the Shipping Committee of the Manchester Chamber of Commerce should be composed of steamship owners.

The Anderton Lift.—The Anderton Lift which has been under process of reconstruction, is nearly completed. Last summer the bank of the North Staffordshire Canal near Marbury, a mile from Anderton, gave way, closing the route to traffic. Hitherto Anderton had been the junction of the river Weaver with the North Staffordshire Canal to the Potteries. The accident, occasioning the temporary closing of the route, made such changes necessary as involved a journey of 81 miles to Stoke, compared with the direct journey of 44 miles *via* the Anderton Lift. In reconstructing the Lift it will be able to transfer more tonnage than has hitherto been possible. Its two troughs will now work independently of one another instead of interdependently, as heretofore.

Sound Signals.—Mr. John Gardner of Fleetwood, has invented a peculiar form of microphone, or sound magnifier, to move a relatively ponderous piece of mechanism—the armature or tongue of what is known to telegraphists as a popularised relay. The movement of Mr. Gardner's invention corresponds with the duration of the sound, and not with the individual vibrations of which the sound is composed. Submarine signalling may be rendered more simple by the invention.

The Rochdale Canal.—The net revenue of the Rochdale Canal Co for the last half-year was £2,879, which, with £1,670 brought forward, left a total of £4,549 available for distribution. This allows a dividend of 10s. per cent. per annum for the half-year. A larger tonnage than ever before has been carried, but there have been heavier charges for storage and insurance.

Liverpool Steamship Owners' Association.—During the forty-nine years the Liverpool Steamship Owners' Association has been in existence, the tonnage of the vessels entered and cleared in the foreign trade of Liverpool has increased from 4,935,880 tons in 1859 to 15,270,858 tons in 1906. In the same period the port has developed the largest oversea passenger trade of any port in the United Kingdom. During the past twenty-five years 7,000,000 passengers have passed through Liverpool on voyages to or from countries out of Europe.

The Isle of Man Steam Packet Co. last year, despite the very wet summer season, created a record. The receipts amounted to £188,965. After payment of all expenses and charges, £45,155 was paid to the new steamer, now being built, £5,000 was transferred to reserve fund, and the balance, £12,019, allows a dividend of 6¼ per cent. The question of a Sunday service is to be considered. Last year, because the Company declined to fall in with one of the railway company's desire to run a boat on Sundays, the Company put on a steamboat of their own.

Miscellaneous.—The extension of producing plant generally over the world during the past few years, and especially last year, has had something to do with the great trade boom which we have been experiencing. This is shown by the exports of British textile machinery. During January there was a further increase as compared with previous years. The total declared value for the month was given as £773,611 as against £628,252 for January, 1907. Next to British India, France and Russia were our best customers. The United States showed a significant falling off, and Japan a continued brisk demand.

A Manchester engineering firm has just completed a series of three-chamber high lift pumps for the Montreal Water and Power Co., which are each electrically driven and capable of delivering 10,500 gallons of water per minute against a head of 405 feet. The power is provided by a three-phase motor of 1,600 brake horse power, taking current at a pressure of 2,200 volts and 63 cycles per second, and making 465 revolutions per minute.

The Lancashire iron trade has been gradually decreasing in values of both pig and manufactured iron during the past month. The weekly reductions in prices have had very little effect in increasing the demand. In fact customers, having expectations of a further fall, only buy to meet passing requirements. There is no speculative spirit in the market. American and German competition is also very keen, and forces the English makers to try and combat with the foreigner. The effect has been to curtail English production. A number of smelting furnaces have been damped out. Still the engineering trades are well employed, especially in textile machinery, the orders in hand being ample to last for many months to come. Many large foreign contracts for engineering and railway work have also been secured by Lancashire firms.

Unlike iron, the coal markets of Lancashire have continued firm throughout the month. Coal for the home, for the mill, and for shipping is in brisk demand, without any signs of falling off. Miners' wages are now at the maximum, there is less coal brought to the surface, and with the expected legalization of an eight hours' day in mines, the prospects of lower prices for coal are very remote. Prices at the pit's mouth have not changed since September, and house coal in Manchester is selling at from 18s. 8d. to 21s. 8d. and even more per ton.

THAMES.

(From our Own Correspondent.)

Port of London Bill.—The general position of this matter has advanced from where it was last month. The Dock Co. have had their say again, and the leading Company will deposit a Bill again to show their view. In the meantime, they say their earnings are between £600,000 and £700,000 a

year. They also say 75 per cent. of the goods which go into the docks pay no port charges at all. As it is, till something is decided they are at a standstill as to building new docks to accommodate large ships as at present authorised, and as regards any new authority it is pointed out that new sites for docks, though available, may not attract the shipping community. The Government has made enquiry of the London County Council as to the assistance it will give in the matter and the answer is favourable in the event of approval of a scheme as regards the provision of further dock accommodation, but that the Conservancy powers are sufficient as regards funds for the deepening of the river, and that therefore the Council does not feel itself able to agree to any contribution towards this improvement. As to the guaranteeing the new port stock, the reply is not favourable without further information as to the Government proposals. As to further dock accommodation, however, the Council, if satisfied and given power to protect the ratepayers from loss, will lend assistance. The shipowners have also spoken, and are in favour of the existing dock companies raising further capital so that the dues on steamers would be down to 1s. per ton. Proposals are formulated and the dues payers will control the authority if these views are embodied in the Government Bill. In this arrangement the companies would remain much as they are now, but under control of the authority, and if they cannot build new docks, the authority to have powers to treat with new concerns for the purpose. The port authority will levy tonnage dues upon ships and users of the river and goods. The shipowners are thus against dock purchase and will only guarantee interest on new docks, and this principle in a measure coincides apparently with the views of the County Council.

Thames Steamboats.—The end has seemingly come in this matter, the Council advising to sell the boats after a loss in the three years' working of £137,000. In that case the pier would be reconveyed to the Conservancy, thus saving £15,000 a year for maintenance of these alone. It was shown, what is partly true, that the Council trams along the Embankment have been a competitor to their own steamers. The boats have proved a disastrous speculation, the capital indebtedness being £277,566. The general conclusions come to were that the service has been purely a holiday service, and therefore can never pay a public body to run. Finally, it is advised that the debt shall not continue for the original period of 25 years, but be paid off as quickly as possible.

The Royal Mail s.s. "Asturias."—This vessel has in her visit to the Thames been pronounced as the finest craft that has ever entered the river, and though only making the one voyage to Australia, has certainly shown here what the company can do. Though severing their connection with the Orient Line next year, the company will continue in the Australian service. We may reasonably expect, therefore, to see and hear more of this enterprise thus entered upon in the near future.

The London County Hall.—The design for this building on the River Embankment has been selected. The plans show a fine noble building, and it cannot but be said that when constructed the building will be an ornament to the river, and the site is such that what was before not much in keeping with the surroundings with this new hall will have distinctly improved the amenities of the neighbourhood. The cost of carrying out this plan is £750,000, which is £100,000 under the figure mentioned in the instructions to architects.

Southwark Bridge.—Negotiations are proceeding between the City Corporation and the London County Council with reference to the widening of this bridge and the running of cars over as in the case of Blackfriars Bridge. Of course the question is a very different one from that of Blackfriars and therefore not so easily decided, but that the matter is under consideration shows that there is a likelihood of something being done.

Sea-going Training Conference.—An important meeting has been held, under the presidency of Lord Brassey, of County Councils to see if some of the educational funds could not be used for training boys for the sea by way of nautical scholarships tenable at training homes, and a strong resolution was passed in favour of this being done in accordance with recommendations which have been made by departmental committees to report on the matter.

The Port of Dover.—The Channel ferry scheme is said to have received certain support from the Government and the railway companies concerned, and if so, we may expect to hear more on the subject. The harbour project is proceeding and the reclamation of land is going on for further developments in the way of a new railway marine station at the port, which should greatly improve the facilities for passengers arriving to and fro. The new Lord Warden, Lord Brassey, has had a civic welcome at Dover prior to taking over his new position.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow.—There has really been no fresh development in the shipbuilding trade in this district since last month, yet at the same time there are any amount of rumours as to future activity. Whether any importance can be attached to them one cannot say at the present time, but certain indications seem to point to a fairly long spell of work. There is certainly no reason why the Barrow firm of Vickers should not be busy, for their yard is the last word in up-to-date yards. There is no department that has been neglected as regards anything. This immense yard possesses all the latest appliances for prompt dealing with all classes of work and a month never passes without there being some improvement. Throughout the driving power is electricity, which is supplied by huge power houses. There are the latest cranes everywhere. The two fitting-out wharfs will be able to deal with quite a large number of warships or large merchant steamers simultaneously. At each wharf there is a huge crane capable of lifting 150 tons, electrically driven, and vessels lying alongside are in direct communication by rail, not only with the yard but with the main line. Such immense improvements would not have been made unless the firm were assured of a large share of work from the British and other Admiralties. Since last month no new orders have been booked as far as the shipbuilding and engineering side are concerned, but the several staffs are busy on designs. Vickers are in treaty with the Russian Government for the designing of battleships. Vickers, if the contract is accepted, will supply the designs, and if the vessels pass their trials—Vickers' men will superintend the building—it will mean something like £400,000 for them. The Russians, to say the least, are difficult people to deal with, and there is a lot of outside influence at work in Russia against such a step on the part of the Government. What will be the result one cannot at the moment say, and it is as well to say as little as possible and believe very little that appears in the press, for already many statements have appeared regarding work done by Vickers for the Russian Government which to anyone with a knowledge are ridiculous. The Russian press requires a lot of understanding.

The Russian Cruiser "Rurik."—This vessel is still at the Clyde and will shortly undergo her gun trials, prior to her departure for Russia.

The North-Western Boats.—The *Slieve Gallion*, the second of the two intermediate boats built to the order of the London and North-Western Railway has been completed. These two ships, the first was the *Slieve Bloom*, are fine specimens of up-to-date designing. They are built for a certain purpose, *viz.*, the carrying of produce and cattle from Ireland, and, at a push, can be used for steerage passengers, when they can carry over a thousand each. They are neat and plain, but the best workmanship is noticeable in everything. They are money-earning boats, for at their contract speed of 16 knots they are being run most economically and are replacing steamers which had a much bigger expense sheet. The fittings are on an elaborate scale. In the stalls for cattle and horses there is over £300 worth of leather in each vessel. Next month it is expected that the passenger boat for the same firm will be launched. This vessel will not be turbine driven, and will be something on the lines of the *Scotia*. She is wanted for the beginning of this season and work is being pushed on her. It is understood that there is some fine work to go in her.

The Isle of Man Flyer.—Next month, about March 20th, there will be launched the Isle of Man flyer, which is to carry some 2500 passengers and beat the records of the *Viking*. This will require some doing, for the Armstrong-built boat did some very big things. The work on this vessel is being pushed on with all speed, for she too is wanted

for the opening of the season. This boat was to be called the *Vanguard*, so it is said, but the Government decided to call their battleship that, and there is a rumour that the Manx Company changed their minds. There is a suggestion that *Neptune* would be a fine name. There is a lot of secrecy about it. The question as to whether the *Viking's* record will be lowered is causing much talk in interested circles. More steam power is the necessary thing, and Vickers are to be trusted to see that the new vessel is not short. There have been several lessons of late in respect to the running of turbines and a restricted steam supply.

The Brazilian. Work on the Brazilian battleship proceeds slowly. It is feared that some considerable time will elapse before she is launched, and the threatened trouble on the East Coast may affect it, for the one at Barrow is being built in conjunction with the one at Elswick. The papers are still having random shots as to the future of these two Brazilians. The "Saturday Review" says they will be hawked about the same as the *Libertad* and *Constitucion*—afterwards the *Swiftsure* and the *Triumph*—and that England, if there are any war clouds about will be compelled by a certain party in this country to purchase them. Another report is that they are intended really for Brazil, and mark the first step towards a new navy. Others don't hesitate to say that they are being built *for* Brazil *for* certain financiers who have a customer in their eye. We shall see what we shall see, and probably some of us will be surprised. There is one thing, and that is the *Brazilian* and the new battleship building to the order of the British Government are about the same size, yet the Britisher is the more powerful as regards engnies. The latter is driven by turbine, while the *Brazilian* is driven by reciprocating engines. Now, it will be interesting to see which vessel gives the best results. There are many who do not look upon the turbine with any great amount of admiration, and argue that the old-fashioned engine is the most reliable, does not take up as much space and is not such a steam eater as the turbine. Several recent happenings have been made the most of by the anti-turbine advocates.

The "Vanguard."—After all the *Dreadnought* to be built at Barrow is not to be called the *Rodney*, but the *Vanguard*. It is now stated that the name *Rodney* was never thought of. One wit suggested that she could be called the *Peace Conference*, as the placing of the order was a result of that conference. This ship has to be built in two years, and there has to be a very important reason or excuse for exceeding that period. Material is ordered and is being got ready, and as soon as the Isle of Man turbine steamer is off the ways the *Vanguard's* keel will be down. There is to be no loss of time and every department has its orders to hustle. The revival of the old name of *Vanguard* brings to one's mind Nelson, who had a vessel of the same name as his flagship in the battle of the Nile.

The Mexican Transport. This vessel, which is as much a cruiser as a transport, is progressing in its fitting out at the wharf, but some time will elapse before she is ready, as there is a lot of work to do yet. In appearance she is somewhat peculiar with her cruiser stem and stern, broad beam, short length and small funnel. As far as power is concerned, the *General Guerrero* is not going to do great things, being only single screw, yet this boat will prove of great service to the Mexican Republic.

Submarines.—The "C13" has been completed and the tender H.M.S. *Hazard* has taken her off to Portsmouth. More work seems to be going on in this department than has been, and it is only a few weeks ago that the "C12" left. Two more of these mysterious craft are fitting out at the wharf and appear to be of the same class. These two will complete the "C" class. There has been a slight alteration in the numbering of these vessels. Up to the present they have only had on the class number, but the "C13," in addition to the class number forward and aft on the tiny metal flag, which marks the whereabouts of the submerged stern, has on the tower amidships the number "43." This is the new style of numbering. The "D" class, which are now being constructed, are said to be of larger dimensions and possessing more power. It is also said that they will have another torpedo tube. But that remains to be seen. The two submarines for Japan are well under construction.

Repairs—Vickers are busy on the repairing of several of the huge paddle steamers belonging to the Isle of Man Steam Packet Co., which are lying up at Barrow. The *Prince of Wales* is at the present time under the big crane with her paddles off, and is getting new paddle boxes. Altogether there are six of these flyers lying up at Barrow, including the *Viking*.

Engineering This department is very busy and is likely to be for some time. Vickers are building their own turbines for the *Vanguard* and the Isle of Man boat. In addition to this they are engaged upon the whole of the Brazilian's machinery.

Shipbuilding Material.—The demand for shipbuilding material continues to be fairly brisk, and the Barrow works have been kept moderately engaged. Most of the orders are from Vickers and Belfast. Plates are a little cheaper.

Hæmatites —Very little business is doing in the hæmatite iron trade. The price for mixed Bessemer numbers is down to 59s. per ton net f.o.b. At the present time there does not seem to be any chance of a revival in the trade, and the prospect only seems to be very poor.

Shipping There is a very heavy falling off in shipments of iron and steel. As compared with the same period of last year there is a decrease of no less than 56,322 tons. This year's figures are 66,339 tons, while last year's are 122,661.

SOUTHAMPTON.

(*From our Own Correspondent.*)

The White Star Liner "Majestic."—In consequence of a serious fire which occurred in the smoking room of the above vessel, the sailing list of the Company has been revised. We understand the extent of the damage was about £1,000. Two of the Company's vessels are at present lying idle, the other vessel being the *Teutonic*, which has been in the Trafalgar Dry Dock for the last six weeks undergoing an extensive overhaul.

The White Star Line—The travelling public do not always favour the high-speed ship, and this is made evident by the return of passengers landed at New York in which the White Star Company head the list with the largest number of first-class passengers. The average per ship sailing from Southampton being 219 in the later part of the year, and 165 per ship from the Mersey in the early part of the year. The second place is taken by the Cunard Company. The Hamburg American line come third on the list with about 143, and the North German Lloyd take fourth place with 124 per ship.

The above figures are for New York only. As is well-known the White Star Company and the Cunard Company also have services from the Mersey to Boston, whilst the White Star Company in addition run steamers from Boston to the Mediterranean. Taking the Boston trade into account, the White Star Line comes out pre-eminent, its figures westward being nearly 3,000 in excess of the next competitor, whilst eastward the figures are nearly 5,000 in excess.

The figures are as follows: first-class passengers, 1907.

White Star Line	(West)	19,870
	(East)	20,436
		40,306
Norddeutscher Lloyds	(West)	17,051
	(East)	15,849
		32,900
Hamburg American	(West)	16,991
	(East)	15,692
		32,683
Cunard Line	(West)	13,960
	(East)	13,276
		27,236

The Royal Mail Steam Packet Co—Two of the four largest vessels launched during the year 1907 were built to the orders of the above Company. These vessels were the *Asturias* and the *Avon*—with gross tonnages of 12,200 tons and 11,073 tons respectively. Very satisfactory reports are being received of the progress of the *Asturias* which is now on passage to Australia, having taken this sailing in place of the *Oroya*, which has been transferred to the Company's

West Indian route. It speaks well for the Company that every berth in every class on the *Asturias* has been taken for the homeward journey. The total registered tonnage of the regular fleet of the Company is now 204,570.

The Company's vessel *La Plata* has been disposed of to the Polytechnic Touring Association and will henceforth be known as the *Viking*. The *La Plata* was originally the *Moor*, of the Union Steamship Co., and has been employed for a number of years on the Royal Mail Steam Packet Co.'s West Indian route. She completed her last voyage for the Company on the 27th January last. She will in future be employed running tours to Norway, etc.

Some Remarkable Coincidences.—On the arrival here of the Dutch Mail steamer *Vondel* on Sunday, the 9th February last, she reported having been in collision with a schooner off Dungeness during a dense fog. The schooner it has since been ascertained, was the *Pool Fisher* of Barrow, which immediately sank and her crew of eight were drowned. The *Vondel* after standing by proceeded to this port in a damaged condition. On Tuesday morning, a sister schooner, the *Ford Fisher*, was passing the scene of Sunday's accident, when she was run into by the steamer *Bittern* of the Cork Steamship Co. The collision occurred practically on the same spot as that between the *Vondel* and the *Pool Fisher*. Both steamers on arrival were repaired by the same firm, *i.e.*, Messrs. Day, Summers & Co. of Northam, who executed the repairs in a very expeditious manner, and neither steamer was delayed.

Southampton as a Torpedo Base.—A rumour has gained currency that the Admiralty have under consideration the advisability of constructing a torpedo base in Southampton Water, in consequence of the congestion of Portsmouth Harbour by the presence under the Home fleet system of so many warships at moorings in the stream. Another factor which is said to be having considerable weight is that owing to the work of constructing the new lock, the approach to the Fountain Lake will be partially blocked during the two or three years necessary to complete the lock. The Portsmouth Reserve flotilla comprises the parent ship *Hecla* two scouts, a torpedo gunboat and twenty-four destroyers and several torpedo boats. The whole of this flotilla could be accommodated without in any way interfering with the ordinary commercial navigation. Moorings would be put down off Netley, where some years ago extensive dredging operations were effected in order that large battleships could be coaled. Southampton Water is an ideal situation for such a base, and if the rumour should prove to be correct it will mean an influx of some two to three thousand people into the town, which should materially benefit in consequence.

HARTLEPOOLS.

(*From our Own Correspondent.*)

Docks.—It must be gratifying to the ardent workers, and those concerned with the welfare of this port, that the goods and minerals handled for the past year have exceeded all expectations. In 1905 the tonnage exported and imported was 783,000 tons, in 1906 956,000 tons, and last year 1,101,000 tons. The Harbour Commissioners are endeavouring to make the channel and entrance to the harbour deeper, which in a place like this, directly on the sea-board, is somewhat difficult, but with their efficient dredgers are making satisfactory progress, and the North-Eastern Railway Company, who own the docks, are contemplating to enlarge the entrance to the docks from the sea at a cost of £92,000, so as to be able to take in a ship of now the normal beam, which, a few years ago, when these docks were constructed, would have been considered leviathan. The chairman of the North-Eastern Railway Company is reported to have stated, that shortly they might have to spend £150,000 for the betterment of the docks, making them still more up to the requirements of the present day ships, that is to say, cargoes can be more expeditiously handled without extra cost to the shipping fraternity.

Engineering.—The upheaval of the industrial labour has so paralysed the trade that although enquiries for new work have been in the market the orders have not been placed in this district. We are also in a trade depression, but this slackness has been looming ahead for some considerable period, and the workshops now are becoming bare of machinery in progress of construction and manufacture. The Central Marine Engine Works are like Richardson, Westgarth & Co., with about three sets of triple expansion engines, with this exception, that the latter are making for the different parts of the universe a large number of Contraflo condensers, also their turbine department is busy with some very good and large orders for their turbines.

Shipbuilding.—Irvines & Co. have all their berths full of work, and they have another keel to lay down when there is a vacant slip. This new ship will be 236 ft. 6 in. long and 36 ft. in breadth.

Gray's, and Furness, Withy & Co.'s shipyards remind one who looks in at them of a barren wilderness, but the latter firm have in the water against their quays three ships for the Hamburg-American Line, one of which would have been ready for sea but for the unfortunate labour crisis, the joiners' work not being yet completed.

HULL.

(*From our Own Correspondent.*)

Shipbuilding Crisis.—The men in the shipyard department of the Hull engineering trade have now had their wages reduced for about a fortnight, and whilst the reduction is not appreciated, no trouble is anticipated. Boilermakers, platers, ironsmiths and riveters have had their wages reduced 1s. 6d. a week, and holders-up 1s., whilst a reduction of 5 per cent. on piecework has also taken place. The wages now range from 40s. 6d. a week in the case of platers, down to 28s. 6d. for holders-up. These are the reductions made by the local federated firms. Depression in trade, high price of material and lack of orders is the reason given for the reductions, and has been agreed to by the Shipbuilders' Employés Federation and the Executive of the Boilermakers' and Iron Shipbuilders' Society, and no difficulty is anticipated.

Work in Docks.—There are a few grain steamers in the port discharging, and steamers also loading for the River Plate ports, Mexican, Japan and West India ports, in addition to the regular weekly traders to the near continental ports, but it is a pleasure to be able to state that the port is free from congestion, and steamers are securing prompt turns both at the coal hoists and at the dry docks. This is a state of affairs which has prevailed for some little time now, and is likely to continue onward.

Messrs. Amos & Smith.—Orders for new machinery are not so plentiful as during the past few years, although it is hoped that the fall in the prices of raw material will have a tendency to induce business. Repair work, however, is fairly plentiful.

Messrs. Cooper & Co. have had in the Albert Dry Dock for weeks the steamer *Equity*, to which very extensive repairs are being done to hull and machinery. They have also small craft in their own dry docks and several steamers with general repairs in hand.

Earle's Shipbuilding Co., Ltd., have in course of construction two passenger steamers for the Hull and Netherlands Steamship Co., Ltd., and a steam fishing vessel for Grimsby. The Great Eastern Railway Co.'s passenger steamer *Brussels* is undergoing her annual overhaul at this yard, and repairs are also being executed to other steamers by this company. It is to be regretted that this firm have at present so many vacant berths in their shipbuilding yard.

BELFAST.

(*From our Own Correspondent.*)

Messrs. Harland & Wolff are, at the time of writing, preparing for the launch of the 25,000 tons Holland-American liner *Rotterdam*, and before these notes are in print this huge vessel will have taken the water. The *Rotterdam*, which will doubtless be the biggest vessel launched during 1908, is somewhat similar to the White Star liner *Adriatic*, launched from the Queen's Island in 1906, and every feature calculated to enhance the luxury of modern ocean travelling will be introduced. On the 25th of January, Messrs. Harland & Wolff completed and handed over, after a highly satisfactory trial

the new Leyland liner *Median*. The vessel has a gross register of about 6,300 tons, and is 413 feet 3 inches long by 52 feet broad, by 30 feet 6 inches deep. Before these notes appear, the fitting out of the *Memphian*, built for the same owners and a sister ship of the former vessel, will have been completed. Amongst other well-known firms for which Messrs. Harland & Wolff are at present building may be mentioned the Atlantic Transport Company, and the Aberdeen line. The vessel for the former concern will be another addition to the long list of leviathans built at the Queen's Island, and the *Pericles*, for the latter company, far exceeds anything sailing in this well-known fleet, being a vessel of 12,000 tons gross. She is at present at the fitting-out wharf, and will be ready for sea in the course of a few weeks.

Messrs. Workman, Clark & Co.—This firm has, amongst other recent orders, secured the contract for the building of one of the much-talked-of new Orient liners. In a recent issue of the *Marine Engineer*, reference was made to the number of fruit carrying steamers which have within the past few years been entrusted to Messrs. Workman, Clark & Co. for construction. During the month of February they have completed and sent to sea one, and launched another. The former, the *Coppename*, is 352 feet long, with a gross tonnage of 3,500, and is owned by the West Indian Mail Co., of Amsterdam; and the latter, named *Marowijne*, is for the same owners, and a sister-ship of the *Coppename*. The propelling machinery of each of these steamers consists of a set of triple-expansion engines, with all the most up-to-date auxiliaries, steam being supplied by three boilers working under Howden's forced draught system.

Messrs. MacColl & Co. have recently carried out a fair amount of repair work, and are at present fitting on board at Ayr, twin-screw engines of 1,000 I.H.P. for the steamer *Cariboo*, building by the Ailsa Shipbuilding Co. for Vancouver owners.

Harbour Items—The contract for the construction of the Queen's Road electric tramway has been definitely placed with Messrs. Dick, Kerr & Co. the price being £17,232. The gantries which are used for the conveying of coal direct from steamers at the Queen's Quay to the various coal depots are at present being raised to a sufficient height for the tram cars pass beneath them. The widening of the quay and construction of new storage shed at the south end of the York dock are now almost completed.

Nautical Cookery.—As is well known the Merchant Shipping Act of 1906 compels foreign-going vessels of over 1,000 tons to carry cooks who are qualified either by at least two years' experience at sea or are holders of certificates of efficiency granted by schools approved of by the Board of Trade. One of these cookery training schools has recently been opened in Belfast by the District Committee of the Shipping Federation, and on the 18th of February, at the invitation of the Chairman of the Committee a number of local shipowners, harbour commissioners, and others interested in maritime matters made an inspection of the rooms and partook of a luncheon the menu of which was prepared in accordance with the scale of provisions required by the Board of Trade. On all hands the highest satisfaction was evinced, the opinion being freely expressed that the luncheon was "fit for a king."

JUNIOR ENGINEERS.

XVII.*

Surface Table.

As the rough forgings and castings come into the machine shop they are taken in hand at the surface table. Those parts of any importance and particular form which are to be machined in the lathe centres have length rods made for them a piece of wood upon which are marked the various lengths and diameters from the drawing. This done chiefly for the forgings, usually being unnecessary for uniform parts cut from the bar and castings finished on the chuck or faceplate. Length rods are similarly applied to the machining of turbine rotors and stators, the series of grooves being marked upon the rod, the boring bar positions are set from this by means of a pointer.

* For Articles I. to XVI., see previous issues.

When marking off a rough part it is set up approximately square upon the table, the surface coated with whitewash or chalk, and the centre lines drawn in so as to allow a uniform thickness for machining on all surfaces where possible; the vertical distances are then set off and horizontal lines drawn in as required. Frequently these dimensions can be measured on the part itself, otherwise a chalk board is set up on the table, the centre line marked upon it, and the various distances laid out and transferred to the part by means of the scribing block or surface gauge.

The next operation is to turn the part over on one of the side faces, squaring it up to the table by means of the lines drawn upon it. The centre line is again found and the distances marked off and drawn in as before, and this is repeated if it be necessary to again turn over. It frequently happens that a part is awkward to deal with in this manner, and a right-angled faceplate is then used, which can be squared to the centre line, and the surface gauge worked with, on the plate, at right angles to the table surface. Circles for boring are drawn in if necessary with compasses, wooden centres being employed to fit into the cored holes, and the job passed over to the machines.

The Brown & Sharpe plain surface gauge is of a good type and made in convenient sizes. It consists of a turned base into which is screwed a vertical spindle; a sliding sleeve carrying the scriber needle is fitted to the spindle and locked to it with a bolt and knurled nut; the needle can also be adjusted for small variations in height by means of a knurled screw pin.

Another handy tool recently put on the market by the same firm is an automatic centre punch. A spring trigger is fitted into the hollow body of the punch, which, upon pressing the point of the punch on the job, releases the compression on the spring, when a sufficiently heavy blow is given by the recoil to force the point into the material. It is particularly adapted to the dabbing of finished surfaces, and for small or intricate parts it enables the operator to support the job with one hand while working with the punch, greatly facilitating the marking and maintaining a regular series of light dabs, easily followed by the machinist.

Among the most useful of the smaller tools employed is the dividing caliper, two legs jointed together, one being pointed at the free end for marking and the other bent over at the tip for setting against an edge while measuring a distance off it. A tool for this purpose, which also combines a pair of compasses, has been brought out by Messrs. Schuchardt & Schutte that embraces several novel features. The compass legs have a lock-nut joint, lock nuts being also placed at the ends of the legs into which the scribing needles are fitted. The needles are each pointed at one end and bent over at the other so that, by arranging those needles, the tool can be used as outside, inside or dividing calipers or compasses; it has the further advantage of enabling a circle to be drawn when the centre is several inches above or below the surface by setting to the radius required and then lowering one of the needles the necessary distance.

In order to raise one side of a job relatively to the other, when setting it up for marking, wooden and steel wedges are used, but for the heavier work these become inconvenient and screw jacks are then employed. The L.S. Starrett jack consists of a pedestal base into which is fitted the lifting screw having a square head to suit a key, and also drilled to take a small podger bar, generally the tang of a file. Both pointed and swivel heads are supplied for convenience, and the height of the jack can be greatly increased by the addition of an extension base fitting tight into the pedestal.

With the larger parts, such as cylinders, the necessary height of the scribing block renders it somewhat unwieldy. This is overcome by making it of wood or light constructive steel with a vertical series of peg-holes for the scribing tool and mounting it on a roller base.

When marking off a polished steel surface the lines show indistinctly, this may be remedied by brushing copper sulphate solution over it which leaves a copper tint, and for a greasy surface a small addition of sulphuric acid is beneficial.

The present-day tendency is to dispense with surface table work, as far as possible, and adopt standardized parts machined to gauges. This is particularly so where a specialized system of manufacture has been instituted, although with the large majority the surface table represents the central point around which the machines revolve.

OBITUARY.

Mr. John Corry.—Beyond the members of his own family circle, to whom our respectful sympathies are extended, there are many whose regrets are great at the removal of Mr. John Corry from the place which knew him as the directing head. His quietness of demeanour concealed to some extent the firmness of purpose and the talent which lay behind. To know him was to love and esteem him for the characteristics which moved him to good actions quietly and unobtrusively performed, and although the allotted span of life had been passed by Mr. Corry, it is not easy to realize that his familiar figure will no longer be seen amid the scenes he was wont to visit. He was a shipowner with engineering instincts, and with a warm appreciation of mechanism as well as of architecture, so that he had a capacity of mind which embraced, not only the commercial side of his business, but the details of the floating structures wherein lay the success or failure of his enterprises. He thus took a personal interest in seeing and knowing his steamers and the staff entrusted with the care of them, whether in dry dock, when he could be seen on the propeller stage (interested in the appearance of the surroundings), in the engine room, or on the deck giving kindly greetings to all. He was born at Belfast in 1831, and in his earlier days Mr. Corry was keenly interested in the invention and construction of machinery. He designed a loom and a sewing machine, hitting upon several new and important expedients; he was also one of the earlier photographers, and we understand that the first folding camera was made to his design. He also was architect for several important buildings, notably Elmwood Church and the Presbyterian College in Belfast. During this extremely active and prolific period of his career he did not take any great part in the business which his father and brothers were carrying on as shipowners and timber merchants, but with the construction of their first iron sailing ship in 1859 he became closely connected with the shipowning business, and for nearly fifty years he was responsible for the construction and upkeep of the vessels of the Star Line. He was senior partner of the firm of James P. Corry & Co., managing owners of the Star Line, formerly owners of a fleet of sailing ships, and who now own insulated steamers of an aggregate tonnage of over 35,000 tons, which are engaged in the Australian and New Zealand trade and in the River Plate trade, the latest steamer being the *Star of Japan.* Mr. Corry was president of the Chamber of Shipping in 1885, and was a vice president of the Institution of Naval Architects. He

Photo by Elliott & Fry, London.

Mr. John Corry (Past President Institute of Marine Engineers).

was a member of the committee of Lloyd's Register for over thirty years, and took a very active part in the work. Probably no member of the committee has ever been so well known to the technical and surveying staff. He took a keen interest in the construction of the handsome building in Fenchurch Street, to which the Register was recently removed. He was president of the Institute of Marine Engineers, session 1901-2, presiding at the annual dinner, when he read the poem on The Engineer by Mr. J. A. Rowe, ex-examiner of engineers. He also delivered an address to the members dealing with several details of the Marine Engine and describing the special stern tube constructed to his design and fitted in some of the "Star" steamers.

THE NAVY ESTIMATES.

THE Navy Estimates for the coming financial year were published on the 24th ult., and show an increase of £900,000 over those of last year, the actual figures being £32,319,500 as compared with £31,419,500 for 1907-8. Thus the pendulum which has had a downward swing since 1904-5 is now once more on the upward curve, and it may safely be predicted that for some time to come its tednency must be in this direction. On the other hand, the amount allotted to new construction, which has been falling since the same date, still continues to fall, there being this year a decrease of £554,798, the sum allotted for the twelve months being £7,545,202 as against £8,100,000 for 1907-8. Moreover, this is the smallest provision for new construction that has been made for many years past. It is quite certain that these figures will not please everybody; it is even in doubt whether they will please anybody. Even the nominal increase is only nominal, since the First Lord, in his Explanatory Memorandum, states that the real outlay will only exceed that of last year by a little under £14,000. The increase is, indeed, absorbed by automatic additions caused by increases of pay and pensions, by expenses for improved victualling, by an increased number of hired men in the dockyards, by provision for an additional supply of stores, expenditure on cooling magazines, the subsidy to the Cunard Company, the annual sum to be found for the repayment of loans, and the higher price of coal. These are expenses beyond the control of the Admiralty, and therefore the cutting-down process, which is known to have operated to the extent of nearly half a million, must have found play in other directions.

The new shipbuilding programme for the year, which Lord Tweedmouth calls "modest," is not in fact unsatisfactory. It comprises one battleship, one armoured cruiser, six unarmoured cruisers, sixteen destroyers, and two or three submarines. The two armoured ships are to be built in the public dockyards at Portsmouth and Devonport, and one of the unarmoured ships will succeeded the *Boadicea* at Pembroke. The amount of money allotted for these three vessels is about the usual sum set apart for the first year. But on the five unarmoured cruisers, which are to be built by contract, barely £7,000 is allotted for each, making it certain that either the contracts will not be given out until the end of the financial year, or that a supplementary estimate will be necessary. On the whole, it may be admitted in fairness to the Admiralty, that this programme is a sufficient one, looking only to present needs. There is, however, a significant sentence in the First Lord's Memorandum which has an ominous ring. He says that owing to labour disputes the construction of the contract-built ships has been delayed, and remarks that "a continuance of this delay may involve a modification in the number of ships given above." It is difficult to see how the numbers referred to above admit of modification. With regard to Rosyth, the plans are now said to be ready, and a contract is to be entered into for carrying them out. This work is to cost £3,250,000, and is to be completed in ten years. An item of £35,000 is put down for the purpose of making a beginning, and criticism will probably be directed to this point. Finally, Lord Tweedmouth reviews the general progress of recent reforms and pronounces them to be "entirely well-conceived and salutary." It is manifest, therefore, that the Government have no intention of granting that inquiry into naval administration which has been demanded in some quarters. He adds that time is now required for the Service to digest and assimilate the new arrangements, and caution will be used in bringing forward further schemes at present. This is excellent. The Navy requires above all things rest.

S. T. Taylor & Son, of Scotswood-on-Tyne, have covered with their "Tynos" non-conducting material the boilers, pipes, etc., of the S.S.'s *Antares*, *Flora*, *Fernandina* and *Lotusmere* and the boilers, etc., of the *Jervaulx Abbey* with their "Tynos" non-conducting material.

The City (late Leask's) Academy of Marine Engineering, of 4 and 5, High Street, Aldgate, London, E.C., scored another record at the last examination of Extra Chiefs, namely, five passes out of the eight successes in London, and also the satisfaction of scoring a success with a candidate for the Board of Trade Surveyorship for Ceylon, which examination was held in London and decided early this year.

Institute of Marine Engineers.—On the invitation of Mr. A. E. Battle, member of the Council, a very enjoyable Bohemian concert was held at the Institute of Marine Engineers, Stratford, on Friday evening, February 14th, Mr. George Adams, member of Council, presiding over a large and appreciative audience. During the interval refreshments were handed round. On the motion of Mr. W. Britton, seconded by Mr. W. E. Harendon, hearty votes of thanks were accorded to Mr. A. E. Battle, convener for the arrangements, with whose name was coupled those of Mrs. Battle and Mrs. Jas. Adamson, who assisted with the refreshments, also to the chairman, on the proposal of Mr. J. H. Silley.

We have received a copy of the Annual Report of the Engineering and Scientific Association of Ireland, whose head office is in Dublin, and the president just retired, Sir Chas. A. Cameron, C.B. The organizations at work throughout the country for the improvement and upbuilding of the various cults are deserving of all the support which can be given to them by those, the details of whose business are embraced by one or another of these. Every young man has now more than ever placed within his reach the opportunity of not only improving his mind by means of the technical classes which abound, but of coming into touch with men of experience, each in his special line of life, whether that line be ashore or afloat. The association referred to during the year has had papers read on the following subjects: "Commercial Testing of Electrical Machinery"; "Coal and its Ash," "Non-conducting Coverings," "The Steam Turbine," "Internal Combustion Engines," "The Theory and Practice of Suction Gas Producers"; also four visits to works, besides social functions. The attendance at the various meetings has been excellent and contrasts favourably with the meetings of other similar societies in proportion to the membership. The new president of the association is John Holliday, Esq.

Sea Rings Packing.—In our January issue two errata occurred in our description and advertisement of this packing, which we desire to correct. In the first place, the word "heat" should be "heel," and in the 2nd the Glasgow address was given as 26 instead of 62 in the advertisement. Sea rings are being used on the 9 in. rods on the men of war of the Japanese Navy, 40 vessels in all are using Sea rings in this navy alone. For hydraulic work ashore they appear to be proving themselves so efficient both as to durability, absence of leakage and reduction in wear and tear on the rams, that we understand several well-known makers of pumps and hydraulic machinery in Great Britain are themselves fitting Sea rings to their machines before sending them out from their works. We understand that Sea rings are patented in practically every country, and agencies are already at work in many parts of the world. Every Sea ring is hand-made and is guaranteed free from any flaws or defects or faults of material or workmanship. For boiling water pumps where practically no other packing has been found to stand, except for very short periods, we understand Sea rings have been running for fourteen months continually, working day and night without a "weep," with rods burnished and without a scratch.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES English.

Antares.—On February 4th, Messrs. Osbourne, Graham and Co. launched from their yard at Hylton, the steel screw steamer *Antares*, which they have specially constructed for A. Kroger, Esq., of Christiania. She is built on the single-deck principle, with all accommodation on bridge amidships, rooms for the captain and officers being very handsomely fitted out in hardwood and of large size. Vessel carries 3100 tons on a shallow draught, and is equipped with the most modern appliances for economical working of cargo. She is built under special rules to Norske Veritas Survey. Water ballast is in both peaks and throughout double bottom, thus enabling the steamer to take long passages light, with the greatest safety. After the launch the steamer proceeded to Messrs. Geo. Clark, Ltd., Southwick Engine Works, who are supplying machinery and boilers. The vessel is fitted with a Cochran (Annan) donkey boiler, with patent seamless furnace. During construction the hull and machinery has been under the superintendence of Mr. Brodrick, of Hull, and also of Capt. Horgen, of Christiania. Mrs. Horgen gracefully christened the vessel as she left the ways.

Arfon.—On February 4th, the Goole Shipbuilding and Repairing Co., Ltd., launched from their Victoria Shipyard, Goole, a large, handsomely-modelled steel screw trawler, her dimensions being, 128 ft. 6 in. over all by 21 ft. 6 in. beam by 12 ft. 6 in. moulded. The trawler has been fitted with the latest improvements, including large steel hood forward for protection of the crew, insulated fish room for preserving the fish, very large steam winch to hold 1,000 fathoms, reserve feed tank, etc. The scantlings are considerably above the requirements of Lloyd's highest class. Triple-expansion engines of good power will be fitted by Mr. W. V. V. Lidgerwood, of Coatbridge. The vessel is the second of two which the Goole Shipbuilding and Repairing Co., Ltd., have built for a new fishing company which has been formed to fish out of Neyland, Pembrokeshire. The trawler and her sister vessel have been built under the superintendence of Mr. J. W. Johnstone, of Neyland. The vessel was named *Arfon*.

Notre Dame de Lourdes. On February 4th, there was launched from the shipyard of Messrs. Cochrane & Sons, Selby, a handsomely-modelled steel screw steam trawler, the principal dimensions being: length between perpendiculars, 155 ft; overall length, 165 ft., breadth extreme, 25 ft., depth moulded, 14 ft. The vessel has been built to the order of Messrs. Vve. Christiaens, A. Bourgain & Co., of Boulogne s/Mer. This vessel with her sister ship launched a few weeks ago are the two largest steam trawlers afloat, and constitute a record for the builders in this respect. She is replete with all the latest improvements for the fishing industry, is to be supplied with an electric light installation throughout, and the holds are insulated with cork, etc., for the preservation of the fish. She will be fitted with powerful triple expansion engines by Messrs. Ames & Smith, of Hull, having cylinders 14 in., 23 in., 38 in. by 27 in. stroke, with boiler 14 ft. by 11 ft., 180 lbs. pressure. As the vessel left the ways she was gracefully christened the *Notre Dame de Lourdes* by Mrs. Bourgain, of Boulogne, after which the company adjourned to the builders' offices where refreshments were served and the customary toasts given and responded to. Like the sister-ship launched previously this vessel has reached the launching stage in a comparatively short space of time, and will be ultimately completed with the same despatch.

Steel Screw Steamer.—On February 4th, there was launched from the yard of Messrs. R. Williamson & Son, Workington, a steel screw steamer of the following dimensions: length 181 ft. 6 in., breadth, 27 ft. 9 in., depth moulded 14 ft. 7 in., and designed to carry 1000 tons deadweight on Lloyd's freeboard. The vessel is built to the highest class at Lloyd's and will be propelled by triple-expansion engines having cylinders 15 in., $25\frac{1}{2}$ in. and 41 in. by 30 in. stroke, steam being supplied by a large cylindrical steel boiler, 14 ft. 6 in. diameter by 10 ft. 6 in. long, working at a pressure of 160 lbs. The vessel has been built by the above builders, and if unsold on completion it is their intention to run her in the British coasting trade.

Steam Trawler.—On February 5th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely-modelled steel screw trawler, the principal dimensions being 130 ft. by 22 ft. by 12 ft. 6 in. moulded. The vessel has been built to the order of Messrs. The Great Central Co-operative Engineering and Ship-Repairing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by them, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was christened by Mrs. A. Cochrane, of Selby, after which the company adjourned to the builders' offices, where refreshments were served and the customary toasts given and responded to.

Kirkham Abbey.—On February 6th a handsomely-modelled steamer, which no doubt will prove a great acquisition to the Hull and Rotterdam passenger and cargo trade, was successfully launched from the yard of Earle's Shipbuilding and Engineering Co., Ltd., Hull. The vessel, which was gracefully christened the *Kirkham Abbey* by Miss Alice Ringrose, is the second of two vessels building to the order of the Hull and Netherlands Steamship Co., Ltd., Hull. The principal dimensions are: length, 255 ft.; breadth, 33 ft. 6 in. moulded; depth, 16 ft. 3 in. moulded. She has been built of steel to Lloyd's 100 A1 class and is of one-deck type with poop, bridge and forecastle erections, also a boat-deck which forms a promenade. She will be fitted with two pole masts and the necessary derricks and gear for the rapid handling of cargo, four powerful steam winches by Messrs. Clarke, Chapman & Co., steam windlass and steam capstan by Messrs. Emerson & Walker, steam steering gear by Messrs. Amos & Smith and hand-steering gear by the Carron Company. There is accommodation for 48 first-class passengers in commodious rooms on bridge-deck amidships, and in house on boat-deck, also spacious dining-saloon and smoke-room amidships; lavatories are arranged adjacent to the state-rooms. Good accommodation is also provided for 28 second-class passengers under poop deck and 44 third-class under main deck forward. The officers, engineers and stewards are berthed alongside engine casing under bridge-deck and the seamen and firemen in forecastle. A complete installation of electric light and bells will be fitted throughout the whole of the vessel by Messrs. Clarke Chapman & Co. The propelling machinery will consist of a set of triple-expansion surface-condensing engines having cylinders $25\frac{1}{2}$ in., $40\frac{1}{2}$ in., and 67 in. diameter, with a stroke of 42 inches. Steam will be supplied by three large cylindrical single-ended boilers with forced draught on the closed-ashpit system, the air being supplied by a large fan and engine in the engine-room. The machinery will be of the most up-to-date design with large bearing surfaces for continuous running, and will indicate about 3,000 horse power. The ship and engines have been constructed under the superintendence of Mr. W. H. Brodrick.

Baro.—On February 15th Messrs. W. Harkess & Son, Ltd., launched from their yard at Middlesbrough a handsome twin-screw mail and passenger steamer, which has been built to the order of Messrs. Elder, Dempster & Co. for their branch service on the West Coast of Africa. The vessel's dimensions are: 225 ft. by 36 ft. by 14 ft. She will carry 1,000 tons of cargo on a light draught, is built to Lloyd's class and a full specification, and carries Board of Trade certificates for about 900 passengers in all. The twin-screw engines are being built by Messrs. MacColl & Pollock, Ltd., of Sunderland, and are expected to drive the vessel at a speed of $11\frac{1}{2}$ knots per hour. On leaving the ways she was named *Baro* by Mrs. Illtyd Williams of Normanby Hall. The builders have just laid the keel of a sister-vessel also for Messrs. Elder, Dempster & Co., and have another passenger steamer on order for them for the Imperial Direct West Indies Mail Service.

Steel Screw Steamer.—On February 18th there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel screw steamer, 200 ft. long, 32 ft. broad, and 13 ft. depth moulded, having raised quarter-deck, short bridge and top gallant forecastle. The vessel will take the highest class in British Corporation under special survey. The steamer was originally contracted for by Messrs. Pile and Co., of London, and sold to the Russian Government. Since then considerable alterations and additions have been made to the vessel in order to thoroughly equip her as a survey ship. Upon completion, the steamer proceeds to the

Behring Seas, for the purpose of taking soundings and making charts. A survey staff and crew of about 85 in number will be carried, accommodation for whom has been fitted both forward, aft and amidships. All weather decks are of wood. Four lifeboats, two motor launches, and a jolly-boat are fitted, together with steam winches, steam windlass and steam steering-gear. Steam-heating is fitted throughout, observation barrel on mast, dark-room for photography, a very complete installation of electric lighting, electric ventilation for crew, etc. The main engines have been constructed by Messrs. G. T. Grey & Co., of South Shields, having cylinders 14 in., 23 in. and 38 in. by 27 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. During construction the steamer has been superintended by Colonel Titoff, I.R.N., on behalf of the Russian Government, and Mr. H. A. Hands, representing Messrs. Pile & Co.

Sagitta.—On February 20th, Messrs. Day, Summers & Co., of Northam Iron Works, Southampton, successfully launched the fine steam yacht *Sagitta*. The yacht has been built to the order and designs of Messrs. Camper & Nicholson, Gosport, for the Duc de Valencay and was gracefully christened *Sagitta* by Mrs. C. E. Nicholson. The Rev. Father Dolman, of St. Joseph's, blessed the vessel previous to launching in accordance with the French custom. The following ladies and gentlemen were present at the launch, which was effected without any hitch whatever :—Mr. and Mrs. C. E. Nicholson and Miss Nicholson, Mr. Arthur Nicholson, Mr. and Mrs. Campbell Day, Miss Norah Day, Mr. Owen Day. The Board of Trade were represented by Mr. A. Currie and Mr. W. J. Elvy, and Lloyd's Registry of Shipping by Mr. John Dykes and Mr. Herbert. Capt. Tizard, R.N., and Mrs. Tizard were also present. The yacht is of the following dimensions : length B.P., 190 ft. 9 in. ; beam, 29 ft. 7 in. ; depth moulded, 16 ft. 10 in. ; and of 800 tons B.M. She has been built to Lloyd's highest class under special survey and will be propelled by a set of direct-acting, inverted, triple-expansion, surface-condensing engines, having cylinders 18 in. by 30 in. by 48 in. with a 30 in. stroke. Steam will be supplied by two S.E. boilers, working at a pressure of 180 lbs. per square inch. The engines have piston valves for the H.P. and I.P. cylinders and a flat double ported valve for the L.P. The cylinders are supported in front on polished steel columns and at the back by cast-iron columns carrying the guides. The surface condenser is built up of steel plates and has brass tube plates screwed to receive the brass ferrules for the tubes. The condenser is carried on cast-iron brackets on the back columns. The air-feed and bilge pumps are driven off the L.P.X. head by links and levers. The circulating pump is of Messrs. Gwynnes' make. All parts of the engines are designed to enable them to be readily got at and are of substantial design throughout. Messrs. Day, Summers are at present busy with extensive repairs and renewals on the Spanish steamer *Valmaseda*, which is at present under the sheer-legs.

LAUNCHES—Scotch.

Hessam.—On February 6th, Messrs. Wm. Simons & Co., Ltd., launched, completed and ready for work, the grab-Hopper dredger *Hessam*, which they have constructed to the order of the Midland Railway for the improvement of Heysham Harbour. The dredger is classed at Lloyd's and is fitted with three of Priestman's cranes and brags, capable of dredging about 500 tons per hour and of dredging to a depth of 48 feet below water-level. The propelling machinery consists of compound surface condensing engines and two steel boilers of sufficient power to obtain a speed of 10 knots per hour. The engine-room outfit includes all the most modern auxiliaries for this type of vessel. The hopper doors are controlled by steam winches, and steam winches are provided at bow and stern for manœuvring the vessel when at work. The vessel has been constructed under the direction of Mr. Baldwin Bent, the Midland Railway Co.'s resident engineer at Heysham, assisted by Messrs. H. H. West & Son, Liverpool.

Taormina.—Perhaps no European nation has in recent years made more rapid progress in its maritime enterprise than Italy, and no little share of the credit is due to one of its premier companies, the "Italia" Societa di Navigazione a Vapore, Genova, which has recently made important additions to its tonnage. Further evidence of this company's progressive policy was apparent when, on February 15th, Messrs. David & William Henderson & Co., Ltd., Glasgow successfully launched the large twin-screw passenger steamer *Taormina* which they have built to their order, the principal dimensions of the vessel being length, 500 ft ; breadth, 58 ft. ; depth moulded, 37 ft. 3 in., with a gross tonnage of about 9000 tons. The vessel has been specially designed for her owners' passenger service between Genoa, Naples and New York, has been constructed under the special survey and to the highest class of the British Lloyd's and Registro Italiano, will comply in every respect with the requirements of the Italian mercantile marine and the American laws, and is replete with everything that can add to the comfort of passengers or the rapid discharge of cargo. Poop, bridge and forecastle decks are fitted above the upper deck, the bridges being surmounted by a promenade-deck over which is fitted a boat deck. Accommodation is provided in the steel house on the promenade-deck amidships for about sixty first-class passengers, and is in keeping in style and comfort with the advance by which the Italian passenger trade is now distinguished. The state-rooms are specially large and airy, the dining-saloon at fore end of deck-house is in polished oak of an artistic design, and immedately aft of same is the music-room and lounge, which is finished off in white and gold. Special attention has been given to the emigrants' accommodation, provision being made for about 2500 persons, for whose comfort everything that the wide experience of the owners could suggest is fitted, such as the special dining-halls in the bridge space, and also on the main-deck amidships. The sanitary arrangements throughout the vessel are of the most complete and up-to-date character, and in addition to natural ventilation, the emigrants' quarters are heated and ventilated on the thermo-tank system. The orlop-deck aft is fitted up as refrigerating chambers, worked by machinery on the carbonic-acid system. Electric light is fitted throughout, with three complete sets of generating plant. Powerful combined hand and steam-steering gear is fitted aft with telemotor connections to the wheel on navigating bridge amidships. The vessel is rigged as a fore and aft schooner with two pole masts, has six cargo hatches worked by derricks and ten powerful steam winches. The propelling machinery will be supplied and fitted by the builders, the twin engines being triple expansion, having cylinders $25\frac{1}{2}$ in., 43 in., 71 in. by 51 in. stroke, and supplied with steam from three double-ended boilers working under Howden's system of forced draught at a pressure of 200 lbs. The construction of the vessel and machinery has been carried out under the supervision of Colonel Squarzini, of the Royal Italian Navy, Sig. Ing. F. Garelli, naval architect for the "Italia" Co., and Captain Roncallo, naval superintendent for the "Italia" Co., who have been assisted by Major Engineer Lauro, of the Royal Italian Navy, and Captains Lavatelli and Falconi. The ceremony of naming the vessel *Taormina* was gracefully performed by Mrs. Fred. N. Henderson, 7, Great Western Terrace, Kelvinside, Glasgow.

Prince Rupert.—On February 19th, Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer *Prince Rupert*, which they have built for the Calvin Co., Ltd., Toronto. The *Prince Rupert* is about 260 ft. in length and is intended for service on the Canadian Lakes. The machinery, which is fitted aft, is being supplied by Messrs. Muir & Houston, Ltd., Glasgow. The vessel and machinery have been built to Lloyd's highest class and under the superintendence of Captain Malone, of the owners' firm, and Mr. Dunlop, of Messrs. John Reid & Co., naval architects, Glasgow. The naming ceremony was performed by Mrs. Ralston Mitchells, Belhaven Crescent, Glasgow.

Acadian.—On February 20th the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, launched a steel screw steamer for the Canadian Lake trade of the Mutual Steamship Co., Ltd., of Port Colborne, Ontario, the vessel is about 250 ft. in length, and has been constructed to Lloyd's highest class, and under the superintendence of Captain J. W. Norcross, managing director of the company. The vessel was named *Acadian* by Miss Bremner, Ardenlea, Greenock, and immediately after the launch was placed in the company's dock to receive her machinery, which has also been constructed by the builders.

Baron Gautsch.—On February 3rd, Messrs. Gourlay Brothers & Co., Ltd., Dundee, launched from Camperdown Shipyard the splendidly-modelled triple-screw steamer *Baron Gautsch*, the first of two which they are at present building to the order of the Austrian Lloyd Steam Navigation Co., Trieste. Among those who attended were Mr. Robert Dussich, chief technical inspector for the Austrian Line; M. A. Davie, assistant; M. Hugo Linfors, chief inspector of the Finska Co.; Mr. M'Farlane and Mr. Walker, surveyors of the Austrian Veritas; Mr. Morrison, of Lloyd's Registry; Mr. Watt, of the Board of Trade; Mr. C. G. Gourlay, and Mr. W. S. Jackson, the manager of the company. As the vessel left the stocks Mrs. C. G. Gourlay performed the christening ceremony. The vessel has been specially designed for passenger and mail traffic from Trieste down the Dalmatian coast, on the eastern side of the Adriatic, no cargo being carried. She is of the awning-deck type, with three complete decks laid, as well as a promenade-deck and boat-deck above, and is constructed to the highest class in Lloyd's and in the Austrian Veritas Registries, under their surveyors' special survey. Her principal dimensions are:—Length, 270 ft.; breadth, 39 ft.; depth, moulded, 18 ft.; while her gross tonnage is about 2000. The hull is constructed entirely of mild steel, sub-divided by four water-tight bulkheads, and fitted with a double bottom for water ballast. She has a steel lower-deck, pine main-deck, and steel awning-deck sheathed with teak. The total number of passengers arranged for is 280. The second-class passengers (forty) are berthed aft, with saloon on main-deck and social hall above, panelled in pine, with mahogany dado. The third-class passengers (150) are accommodated forward on main and lower-decks. The officers and engineers are berthed in rooms amidships, and the seamen in the forecastle, and firemen and stewards on lower-deck aft. The ship is heated by steam, and a system of mechanical ventilation has been fitted up. She will have a complete installation of electric light, and two electric elevators for handling mails and passengers' luggage have been arranged, one forward and one aft.

Grangemouth.—On February 3rd, the Greenock and Grangemouth Dockyard Co., Ltd., launched from their Grangemouth yard a screw steamer built to the order of Messrs. James Rankine & Son, of Glasgow, Grangemouth and Rotterdam, for their passenger and general trade between Grangemouth and Rotterdam. The vessel, which was named *Grangemouth* by Miss Annie Macgill, is a thoroughly up-to-date Continental trader, and embodies all the results of the long experience of the owners in this service. Machinery of high power is being supplied by Messrs. Dunsmuir and Jackson, Govan, for a speed of 15 knots in loaded trim. The vessel and machinery have been designed by Mr. William Filshie, superintendent of Messrs. James Rankine & Son, who has been associated in the superintendence of the work by Mr. David Macgill, Grangemouth, and Mr. David Macgill, junr., Glasgow.

Cadiz.—On February 3rd, Messrs. Charles Connell & Co., Scotstoun, launched a finely modelled steel screw steamer, named *Cadiz*, of about 5150 tons gross, for Spanish owners. She has been built to accommodate sixty first class, eighty second class, twenty-four third-class passengers, and also 1000 emigrants. The vessel has been built to Lloyd's 100 A1 class, with three decks, and also poop, bridge, topgallant-forecastle and boat-decks. A complete installation of electric light is fitted throughout. A powerful set of triple expansion engines is being supplied by Messrs. David Rowan & Co.

Lady Blake.—On February 13th, the Caledon Shipbuilding Co., Ltd., Dundee, launched a steel screw steamer built to the order of the Ceylon Steamship Co., and christened the *Lady Blake*. The new steamer is of the twin screw type and her dimensions are:—Length overall, 230 ft.; breadth moulded, 37 ft.; and depth moulded, 13 ft., with a gross tonnage of 1300 tons. The vessel carries a limited number of first and second-class passengers, for whom accommodation is provided in large, airy, and well appointed state rooms contained in a large deck house amidships, at the fore end of which is the first class dining-saloon, tastefully panelled in light oak. The officers are also berthed in a midship deck-house and a roomy steel deck-house immediately above the saloon contains chart and captain's rooms, while the crew are comfortably berthed aft. The deck machinery consists of large donkey boiler, steam windlass, steam capstan, and steam-steering gear, while two large hatchways are fitted and worked by four steam winches. The vessel is fitted throughout in a first-class manner, and has a complete installation of the electric light. After the launch the *Lady Blake* was towed to the large crane at the Victoria Docks, where she will be fitted with propelling machinery of the triple-expansion type, having cylinders 13 in., $21\frac{1}{2}$ in., and 35 in. diameter, with a stroke of 24 in. Steam will be supplied by a large boiler working at a pressure of 180 lbs. The machinery is being supplied from the Caledon Co.'s Lilybank engine-works.

Castle Eden.—On February 7th, the Grangemouth and Greenock Shipbuilding Co. launched at Greenock the screw steamer *Castle Eden* for Messrs. Furness, Withy & Co., West Hartlepool. Length, 276 ft.; breadth, 40 ft. 6 in.; depth, moulded, 20 ft. 6 in. The vessel will carry 3250 tons on a draught of 14 ft. 9 in. She is of the single-deck type, with poop bridge on forecastle. Messrs. Dunsmuir and Jackson, Glasgow, will supply the engines, which are to produce a speed of 11 knots. The naming ceremony was performed by Mrs. W. Millar, Towerlands, wife of the managing director of the shipbuilding company.

Atlanta.—On February 7th, Messrs. Russell & Co., Port Glasgow, launched the steamer *Atlanta*, built for Messrs. Fratelli Cossulich, Trieste. Dimensions:—Length, 385 ft.; breadth, 49 ft. 9 in.; and depth (moulded), 29 ft. The *Atlanta*, which will have a dead-weight carrying capacity of 7350 tons, is intended for passenger and cargo trade between the Mediterranean and North and South America. After the launch she was towed to Glasgow to be engined by Messrs. David Rowan & Co.

Cassandra.—On February 19th, Messrs. Scott's Shipbuilding and Engineering Co., Ltd., Greenock, launched the twin-screw steam yacht *Cassandra*, which they have built to the order of Mr. Roy A. Rainey, New York. The yacht has been designed by Mr. A. S. Chesebrough, of Bristol, Rhode Island, and constructed under his superintendence. The dimensions are:—Length, 284 ft. over all, and 239 ft. on the water line; beam (moulded), 33 ft.; and depth, 20 ft. 6 in. She is fitted with water-ballast tanks. Built to 100 A1 at Lloyd's under special survey, she is of the shade-deck type, having a continuous deckhouse and shade-deck 136 ft. long. On the shade deck is also a teak deckhouse about 55 ft. in length, and above this is the navigating bridge. The owners' and guests' rooms, which are both fore and aft of the machinery space, consist of twelve state-rooms and seven bath-rooms. The dining, smoking, and other public rooms are finely finished in walnut, teak and mahogany. The machinery consists of two sets of triple-expansion engines to develop about 3000 horse-power. The vessel was named by Miss Janet H. Scott.

Trawlers and Drifters.—On February 20th, Messrs. Alexander Hall & Co., Ltd., Aberdeen, launched a steam drifter to the order of Mr. Edward Gordon, Fraserburgh. The dimensions are:—Length, 86 ft.; breadth, 18 ft.; and depth, 9 ft. 6 in. Messrs. Hall, Russell & Co., Ltd., Aberdeen, on the same day launched two trawlers to prosecute fishing in South America.

Matthew Keenan & Co., Ltd., have completed the covering of cylinders, boilers, pipes, etc., on the Lloyd Sabando boat *Principe di Udine* built by Messrs. Barclay, Curle & Co., Whiteinch.

LAUNCH—Irish.

Marowijne.—On February 1st, Messrs. Workman, Clark and Co., Ltd., Belfast, launched from their South Yard the second of two steamers being built and engined by them for the West Indian Mail Company, of Amsterdam. The new steamer has been named *Marowijne*, and has been specially designed for the West Indian fruit-carrying trade. This is the thirteenth vessel built for this trade by the above firm, who have at present several other vessels in course of construction for the fruit trade. The *Marowijne* is 352 ft. in

length with a gross tonnage of about 3,500, and has been built under special survey for the highest class in Lloyd's Registry of Shipping. The cargo space is divided by the decks and bulkheads into fourteen compartments, eight of these being specially arranged and insulated for the carriage of fruit cargoes in bulk. For the preservation of this cargo during the voyage, the several compartments are fitted with ducts for the delivery of cooled fresh air from the cooler rooms on the deck, and efficient installation of refrigerating machinery being placed in the engine-room. The cargo hatches are equipped with the necessary winches and other approved appliances specially adapted for expeditiously handling fruit cargoes. Accommodation for a number of passengers is arranged in comfortable state-rooms in a large house on the bridge-deck and at the ships' side on the spar-deck, with commodious dining-saloon at the forward end of the bridge space. From the saloon corridor a stairway leads up to the social hall or lounge on the bridge-deck, with a comfortable smoke-room adjoining. The officers' and engineers' rooms are placed on the spar-deck amidships, while the crew are berthed in a steel deck-house aft and the petty officers in the forecastle. The machinery and boilers consist of a set of triple-expansion engines with all the necessary auxiliary appliances, and three steel cylindrical multitubular boilers working under Howden's system of forced draught.

Wailes, Dove & Co.'s bitumastic covering has been supplied to the tank top in boiler space and their bitumastic enamel to the bunkers and ship's sides in boiler space of the s.s. *Waitemata*.

TRIAL TRIPS.

Gordonia.—On January 25th, the new screw steamer *Gordonia*, built by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of the Gordon Steam Shipping Co., Ltd., London, was taken to sea on her official trial trip fully laden. Her dimensions are :—Length overall, 358 ft. ; breadth, 49 ft. 6 in. ; and depth of hold, moulded, 27 ft. 11 in. She is of the single-deck type, built to Lloyd's highest class, and designed to carry 6700 tons on a moderate draught, having cellular double bottom fore and aft, and fitted with poop bridge and forecastle. There are steel houses for the captain and officers, and also for the engineers and apprentices, which are constructed on the bridge-deck, the crew's quarters being in the forecastle. She is fitted with eight steam winches and every facility for the rapid and easy handling of cargoes, and also with shifting boards and feeders throughout the holds for grain cargoes. The vessel is fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, having cylinders 25 in., 42 in., 68 in. and 45 in. stroke, supplied with steam from two large steel boilers working at a pressure of 180 lbs. per square inch. The steamer has been superintended during construction by Mr. Wm. Gates, of South Shields, resident superintendent for Messrs. Gordon. The trial was in every way satisfactory to all concerned, and the vessel afterwards proceeded on her voyage to Genoa, under the command of Capt. John Kidner. Among the company present were Mr. Frederick Gordon, Mr. James Readhead, Mr. John Readhead, Mr. W. Gates, and others.

Grantley.—On January 27th, Messrs. Osbourne, Graham and Co. sent to sea for her official trial the steel screw steamer *Grantley*, which they have specially built to the order of Messrs. Furness, Withy & Co., Ltd., of West Hartlepool, for the Pomeran ore trade. She is a single-deck steamer designed to carry a large cargo on a moderate draught, and takes highest class at British Corporation. Accommodation is fitted in the poop, and the officers and engineers are situated amidships. Her deck equipment comprises all the latest appliances for quick handling of cargo, Cochran (Annan) donkey boilers, with patent seamless furnace, steam-steering gear, etc. Engines have been supplied by Messrs. MacColl and Pollock, Sunderland, and during the trial everything was satisfactory, a speed of 10 knots being easily attained.

Driva.—On January 28th, the steel screw steamer *Driva*, of about 2200 tons deadweight, built by the Campbeltown Shipbuilding Co., Campbeltown, for Messrs. J. T. Salvesen and Co., Grangemouth, ran trials at Wemyss Bay. The *Driva* is of the well-deck type with raised quarter-deck, bridge and topgallant forecastle, and is specially designed for the owners' wood-carrying trade, with large hatchways and clear holds and with steel shifting boards at the middle line and deep framing on the bulb-angle principle. The vessel is built to Lloyd's highest class, has large water-ballast capacity, and all the latest and most up-to-date deck machinery. The propelling machinery consists of triple-expansion engines supplied with steam from a large main boiler working at 180 lbs. pressure. On the trial a mean speed of about 10½ knots was obtained, and everything passed off satisfactorily.

Tuscany.—On February 5th, the new steel screw steamer *Tuscany* (of which we gave particulars in our January issue, page 271), built by Irvine's Shipbuilding and Dry Docks Co., Ltd., and built for the Gulf Line, Ltd., proceeded to sea on her trial trip, and after a very satisfactory test it was ascertained the vessel had attained a speed of 11 knots. Mr. T. Tose represented the shipowners, Mr. Urquhart the engine builders and Mr. Clark the shipbuilders. The vessel is fitted with Cochran (Annan) donkey boiler with patent seamless furnace.

Romanby.—On February 10th, the steamship *Romanby* (of which we gave particulars in our January issue, page 269), built by Messrs. Ropner & Sons, Ltd., of Stockton-on-Tees, made her official trial trip in the Tees Bay. The steamer has been built to the order of Messrs. R. Ropner & Co., of West Hartlepool, and is fitted with the builders' patent improved trunk-deck. After a very satisfactory trial trip, during which a speed of about 11 knots was attained, the steamer proceeded to the Tyne to load. The owners were represented by their superintendent, Mr. J. Nicholson, and the builders by Mr. J. R. Garthwaite.

Coppename.—Messrs. Workman, Clark & Co., Ltd., of Belfast, have added another vessel to the long list of steamers built by them for the banana and general fruit-carrying trade, and it is interesting to note that they have at present several other vessels in course of construction which have been specially designed and arranged for this particular trade. The vessel is the *Coppename*, a handsomely-modelled vessel (of which we gave particulars in our January issue, page 272), built for the Royal West Indian Mail Company, of Amsterdam, left Belfast on February 17th, and after adjustment of compasses in the Lough, crossed the Channel to Ardrossan to coal. Afterwards the vessel proceeded to Skelmorlie to undergo speed trials, which were highly successful, the average speed attained on several runs over the measured mile course being 14½ knots, which is in excess of the contract requirements, while the behaviour of the vessel under all conditions gave the utmost satisfaction.

Dacre Castle.—On February 20th, the large steel screw steamer *Dacre Castle* (of which we gave particulars in our January issue, page 269), built by R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough, for the Lancashire Shipping Co., Ltd. (Messrs. James Chambers & Co., managers), proceeded to sea to complete her official trials in ballast trim. The results were pronounced entirely satisfactory to all concerned, the vessel registering a speed of 14 knots over a 30-mile course

Cochran (Annan) donkey boilers, with patent seamless furnaces, have been fitted on the following :—s.s. *Baron Gautsch*, *Castle Eden*, *Atlanta*, *Manco* and *Lady Sybil*.

Thorn's School of Marine Engineering.—As a further result of the last examination for the Board of Trade Surveyors, held at the Head Offices, London, another pupil from the establishment of W. H. Thorn & Son, 5, Waterville Terrace, North Shields, has received an appointment, making thirty successes in this rank, the highest a marine engineer can attain. One hundred and sixty-three extra chiefs have also obtained their certificates from this school.

REVIEWS.

The Mechanical World Pocket Diary and Year Book for 1908. Manchester : Emmott & Co., Ltd.

This is said to be the 21st issue of this well-known book, and improvements are introduced therein by way of condensing and superheating plant. The type and size certainly favour the editorial portion. It is easily readable, the headings conducing to this, we think. Then as regards the matter, saturated steam properties begin it, with distribution by valves, indicator diagrams and constructional details. The steam turbine is a section clearly gone into, and this not for one type alone. Boilers and their design and settings are noticed with water-tube and locomotive varieties ; gas and oil engines are also found here with beams and strengths of material. Gearing in its various forms is treated at some length, followed by details like bolts and nuts, screw threads and pipe flanges, the general principle of mensuration and logarithms completing the information. What there is here is certainly of a high order, and of easy and ready adaptability by the average reader backed by a proper training.

Official Year Book of the Scientific and Learned Societies of Great Britain and Ireland (7/6). London : Chas. Griffin & Co.

This well-known work is divided into sections, and the societies that concern us come under two or three heads only. The Royal Astronomical is one, for example, with the paper read during the year. There is also that of the London Mathematical Society, the National Physical Laboratory at Bushey, and the Physical Society. In the mechanical science section we have the civil engineers and other bodies of a like character, including the Institute of Marine Engineers, while in naval and military science we find the Institution of Naval Architects. For the purpose intended of giving the papers read at the various societies and the authors' names the work is admirable we should say.

Hints to Engineers for the Board of Trade Examinations. (2/6). By W. D. Martin. Glasgow : James Munro and Co.

This little volume refers to Board of Trade Oral Examinations, and there are over 600 questions to which answers are given with numerous sketches. It opens with density and scale, and the knotty questions appertaining thereto are found here. Then come boilers and their design, followed by defects. The question of combustion and the generation of heat is discussed with details like safety-valves. In engines we have slide-valves and the various gears from Stephenson's onwards. The design of engines in common use are noted, and the ratios of the sizes of cylinders. The question of breakdowns is discussed as being of importance, but applying particularly to engines. Propellers and pumps are two subjects well treated before coming to the chemical question of the constitution of new tubes and gases. Pressure and vacuum gauges lead up to indicators and cords, and here we have for the first time the illustrations in the diagram. As extra subjects we meet with electricity, refrigeration, oil motors and turbines. The sketches mentioned at the beginning refer to those found at the end illustrating gauge cocks, slide valve action pumps, boilers and their seatings. It will be gathered from the above that though impossible to mention everything within the limit of 100 pages, yet the questions and answers given are likely to prove most useful to candidates, and we can quite thoroughly recommend what we find here.

Engineer's Year Book of Formulæ, Rules, Tables, etc., 1908. (8/-) London : Crosby, Lockwood & Son

This well known work makes its annual appearance perhaps larger than usual. Surveying instruments is a section we notice very full and complete, and which would be of utility to naval officers we think. The principles governing civil and mechanical engineering are plainly given, and should prove useful. We find Board of Trade and Bureau Veritas rules for steamships and refrigerating and ice-making machinery is another department closely gone into. Boilers of all types are to the front with numerous details. Engines naturally follow, and motor cars find a place, and with some mention of machine tools, locomotives are next closely discussed with speeds, rolling stock, brakes and signalling. Tramways are so important now that they are introduced fully, and we meet with hydraulic and ordinary pumps. From the author's position we naturally expect the electrical portion to be thorough, and we are not disappointed. We find practically a compendium of the whole subject here. There is a special section of marine engineering, which is of considerable value and comprises Lloyd's rules, particulars of naval and merchant ships, water-tube boilers and all the usual data relating to vessels. There is a full index at the end, and we should say, if it is possible, the present is an improvement on the last issue.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class, 2C Second Class.

December 28th

Adams, F J ..	2C	Aberdeen
Arm, Alfred W	2C	Liverpool
Arnold, Robt N	1C	London
Bailey, John T	1C	Sunderl'd
Barclay, John..	1C	Aberdeen
Barnby, Reg A	1C	N Shields
Bickerton, Wm	1C	Liverpool
Black, Wm. F	1C	Greenock
Booth, George..	2C	Sunderl'd
Campbell, T B	2C	N Shields
Campbell, John	2C	Greenock
Cederberg, A T	2C	Liverpool
Chapman, Robt	2C	Bristol
Cooper, C S ..	2C	N Shields
Coutts, Jos G	1C	Aberdeen
Davidson, R ..	1C	Aberdeen
Davison, J R	2C	Sunderl'd
Defty, Richard	1C	Liverpool
Driver, George	2C	N Shields
Eaglesome, A W	2C	Liverpool
Ellis, Edward	1C	Bristol
Fay, Joseph P	1C	N Shields
Forbes, Charles	1C	Aberdeen
Forde, Ed J ..	1C	London
Grivas, P	1C	Sunderl'd
Hamilton, J D	2C	Liverpool
Howieson, A ..	1C	Greenock
Keating, Walter	1C	Liverpool
Liley, Wm. G	2C	Bristol
Lumsden, Geo	1C	N Shields
MacKay, J S.	1C	Liverpool
Marshall, Wm	2C	Sunderl'd
Meredith, E T	2C	Liverpool
Milne, Jas. E	1C	Aberdeen
Milne, Jas. I ..	1C	N Shields
Miniken, Gilpin	2C	Liverpool
Mitchell, Arthur	2C	Aberdeen
M'Larty, Jas A	2C	Greenock
Morgan, A.	1C	Greenock
Potts, Ernst E.	1C	N Shields
Reid, John F ..	1C	Greenock
Roberts, Robert	2C	Liverpool
Robertson, D. J	2C	London
Robson, T E	1C	Sunderl'd
Rowntree, R W	2C	Sunderl'd
Rutherford, D C	1C	N Shields
Salisbury, Ben	1C	London
Scoon, Scott ..	1C	N Shields
Scott, Jas H ..	1C	London
Spencer, E. J ..	2C	London
Stephen, J H	1C	Aberdeen
Stuart, Jas. R	2C	London
Swaries, G W	2C	London
Tod, Thomas ..	1C	Bristol
Tulip, William	2C	N Shields
Veness, Albt R	1C	London
Wood, Stanley	1C	N.Shields

January 4th, 1908

Allan, Robert ..	1C	Glasgow
Arthur, Jas M	2C	Leith
Brown, G M A	1C	Glasgow
Clark, Rich. F.	2C	Leith
Crawford, J W	1C	Leith
Fairgrieve, Jas	2C	Leith
Ferguson, D L	2C	Glasgow
Gibson, David	2C	Glasgow
Hamilton, James	1C	Glasgow
Highmore, A M A	1C	Glasgow
Hogg, Walter ..	1C	Glasgow
James, John ..	2C	Cardiff
Kay, Thomas S	2C	Glasgow
Kerman, W A	1C	Cardiff
Lamont, Bryce	2C	Glasgow
Marshall, Geo	1C	Glasgow
Methven, W. B.	1C	Glasgow
M'Lean, Herbt	2C	Glasgow
Morrison, R E	2C	Glasgow
Morrison, M ..	1C	Glasgow
Mowatt, R A	2C	Leith
Rankin, Wm ..	1C	Glasgow
Robertson, John	2C	Glasgow
Robinson, J G	2C	N Shields
Smellie, Alex...	2C	Leith
Smith, Jas. M	2C	Glasgow
Thomson, John	1C	Glasgow
Turnbull, Colin	1C	Glasgow
Young, John ..	1C	Glasgow

January 11th

Brett, C. B.....	2C	London
Brown, George	1C	Liverpool
Collie, Thos. M	1C	Liverpool
Howard, W A	2C	London
Pritchard, F G	1C	Liverpool
Taylor, W W	1C	London

January 18th

Allen, Geo H	1C	N Shields
Bullen, Harold	2C	N.Shields
Coates, S E. ..	2C	London
Dean, John	2C	Liverpool
Dewar, William	1C	Dundee
Douglas, James	2C	Dundee
Duckett, F E	2C	London
Dunn, John H	2C	Hull
Forsyth, Peter	2C	Greenock
Hall, Harry R	1C	Hull
Harrison, W V	1C	N Shields
Higgin, Geo B.	2C	London
Huby, Richard	2C	Hull
Kelly, Frank B	1C	Liverpool
Mackenzie, G S	1C	Dublin
Mellentin, E ..	1C	N Shields
Millan, Robert	2C	Greenock
Murdoch, John	1C	Greenock
Newdick, Thos.	1C	Hull
Pettersen, Alex	2C	Greenock
Richardson, H. S.	2C	Liverpool
Vooght, H P	1C	Liverpool
Williams, W. E	1C	Liverpool
Waugh, J.W H	2C	London

The Marine Engineer

And Naval Architect.

LONDON, APRIL 1, 1908.

STEAM TURBINE ENGINEERING

AN interesting paper on the progress of the steam turbine and its development was read by Mr. S. L. Pearce, before the Manchester Association of Engineers, in which he gives a good analysis of the general types of turbines, not forgetting the Parsons turbine, which is the present basis for the large marine orders that have lately been carried out by this firm and by other firms who are working under licence granted on the Parsons specifications. We first may take a definition of the turbine, *viz.*, that it is "a prime mover in which the gradual changes in the momentum of a fluid are utilized to produce rotation of the mobile members." This definition must produce a change in the velocity of the steam, by which the momentum of this body, as a prime mover, is imparted to the revolving portion of the turbine. The grouping of turbines is commonly general under two heads (*a*) impulse turbines and (*b*) re-action turbines but there are many forms of turbine which are formed from a combination of these two results. In the case of impulse turbines there is no difference of pressure and velocity between the inlet and outlet sides of the moving member, whereas in the re-action turbine there is a transformation of the potential energy of the steam into kinetic energy within the revolving apparatus, as well as in the fixed portion of the turbine—that is to say, that in the re-action type of turbine there is a difference of velocity and pressure between the inlet and outlet side of the revolving member, so the inlet side has to work in a medium of higher pressure than the outlet side, which thus serves to cause a considerable loss by leakage, unless the clearances between the fixed and revolving members are kept very fine. Speaking generally, one may say that in the impulse type the steam is expanded in the guides or nozzles only from initial pressure down to atmospheric pressure or vacuum. The velocity of steam when expanded from 160 lbs. pressure to 3 lbs. absolute is about 3,660 feet per second, and in the re-action type the speed of the periphery of the rotors would be two-thirds of that, and in the impulse turbine about one-half of that velocity. Amongst those of the impulse type may be mentioned those of De Laval, made by Greenwood & Batley, but these simple impulse turbines seem to be limited to about 300 h.p. These turbines run at a very high speed, *viz.*, up to 30,000 revolutions per minute for the 5 h.p., and down to 10,000 revolutions per minute for the 300 h.p., and these speeds entail flexible shafts. This turbine and others made by the Allegemeine Electricitats Gesellschaft, of Berlin, and the Oerlikon Company, of Zurich, in the form of the Rateau and Zoelly types, seem to have been used almost generally for driving electrical plant direct, as also those worked from the Curtis Patents, but this latter seems in the States to have been made for large Kilowatt Powers up to 2000 to 4000 k.w. It is to be remembered that 1 k.w. = 1·34 electrical horse power. After Mr. Pearce had given a good deal of consideration to these electrical turbines, he proceeded to deal with "re-action" Parsons turbines, which are really a combined impulse and re-action turbine, and are the type upon which the high powers for marine steam engines are founded. In a turbine of this class the expansion of the steam is provided for in a regular and continuous manner, and takes place in the rotating as well as the fixed vanes. Licences on the Parsons principle are held by Messrs. Williams and Robinson, of Rugby; Richardson and Westgarth, of Hartlepool, and the Brush Electrical Engineering Company, of Loughborough; on the Continent by Messrs. Brown Boveri; and in the United States by the Westinghouse Company. The Parsons type is built with an enormous number of fixed vanes, alternating with a corresponding number of movable vanes, which latter are fixed to the periphery of a rotating drum. In the De Leval or simple impulse type the steam is expanded down in the nozzles to atmospheric or condenser pressure, with the result that the wheel runs in a more or less uniform density, but in the Parsons type the rotors rotate in a high density at the steam admission end, and a very low density indeed at the exhaust or condenser end. From this results an end pressure acting on the turbine in the direction of the steam flow, which must be met by balance pistons, and further there is a tendency to leakage of steam across the rotating blades, from one medium to another medium, unless fine clearances are adopted. In the modern type all radial flow arrangements have been abandoned in favour of the parallel flow, the double flow self-balanced by the single flow balanced by dummy or balance pistons. To give some idea of the number of vanes used in the Parsons turbine, we may state that in a 750 k.w. turbine there would be no less than 15,000 revolving vanes, and a like number of stationary ones—a total of 30,000 in all. These require very great care in the workmanship and a special material, which latter is kept, as far as possible, a manufacturers' secret. The chief consideration underlying the employment of the many stages in the Parsons type is that it allows of a reduction of the speed of the turbine, reducing the peripheral speed to about 400 ft. per second. In the Parsons-Brown Boveri set it has been shown that on full load there was only a decrease of 5 per cent. in steam consumption for a 40 per cent. increase in steam pressure. At about half-load no economy could be shown for the increase, and on low loads the steam

consumption was actually greater for the higher pressure. The result of this and other tests goes to show that there is little or no economy to be obtained on full load by increasing the pressure of the steam admission, and, on the contrary, for lower loads, there may be a distinct loss. The higher the vacuum obtained the greater the range of fall of the steam, so that a distinct advantage is obtained by any increase in the vacuum. Between 60° Fah. and 100° Fah. of superheat there is a decrease of steam consumption about equal to the superheat. The making of the Westinghouse Company is noted for the adoption by this firm of a self-balanced type of Parsons turbine. The steam enters at the centre and flows outward both ways, and this, of course, eliminates the balancing arrangements. Parsons, however, discarded this double-flow type at about the year 1890. With this type of turbine a possible efficiency of 83 per cent. may be reached, but in practice 65 per cent. is hardly reached, owing to the serious leakage of the turbine; but on the score of steam consumption the Parsons type has little to fear. In the use of super-heated steam for these turbines, it is noticeable that the best results are those which do not exceed an amount of 200° Fah. Mr. Pearce enlarges somewhat upon the advantages of condensing plants in giving unusually low vacuum, as this point is of serious import to turbines generally. In the matter of prime costs also he gives many figures that are very useful, as comparison between piston engine cases and turbines, but he certainly gives the best result on this point to the turbine.

Apexior Boiler Compound.—The "Apexior" compound is for coating the internal surfaces of steam boilers of all descriptions to prevent the deposit of hard scale and pitting, and also for coating the external surface of steam boilers and pipes before covering, and any iron or steel work exposed to violent influences, such as from acid or alkaline fumes, as a protection from corrosion. This is not a boiler fluid, but is applied as a paint to the surface to be protected, and is a compound having a carbon base. The compound dries in about two hours after application, and is unaffected by water or steam under pressure, and in view of the extreme thinness of the film applied there is no retardation of the transmission of the thermal units. We have seen copies of reports from the boiler inspector of H.M. Commissioners of Works respecting boilers in public departments which have been treated with the compound, and in every case the results appear to have been most satisfactory.

Congress of the Refrigerating Industries.—It was intended that the International Congress of the Refrigerating Industries should be held at Paris in July, but in deference to the desire of the American, Austrian and Belgian Committees the date may be altered to September. In the matter of the alteration of date the French Central Committee is conferring with the British Committee in order to comply, if found convenient, with the desire expressed by the three nationalities named. The Austrian Committee is a large and influential one, representative of many interests, both land and marine. Germany, Russia and most of the countries of Europe are taking part in the congress.

Artificial Light.—At the Institute of Marine Engineers, on Monday, March 9th, a lecture was given by Mr. A. E. Battle (Member of Council), on this subject. A demonstration was then given, with explanations of the details, showing the development of electricity for lighting, heating and power, by Mr. Holmes, of the West Ham Corporation Electricity Dept. The lecturer, in opening, stated that the earliest form of artificial lighting was probably the camp fire, which would be followed by its natural development, the torch. Vegetable and animal fats and oils were next requisitioned and the lamp brought into use, in its primitive condition consisting merely of a shell containing oil with a piece of saturated cotton hanging over the side, a form which for ages underwent very little change in principle. Great improvements were made towards the end of the eighteenth century, the most successful being one in which the oil was pumped from a reservoir and sprayed upon the wick. The first form of candle was the rushlight, a piece of pith dipped in fat, followed by the tallow dip, which gave place about the year 1850 to the paraffin wax candle. The discovery of the properties of coal gas as an illuminant dated from the year 1739, but its first application was in 1793, and it did not come into general use until the year 1802. The improvements afterwards were chiefly in the direction of purifying the gas and regulating the supply, until the introduction of the incandescent mantle. For many years attempts were made to produce an incandescent light by means of enclosing the flame in a metallic substance, but it was not until 1885 that Baron Welsbach discovered a preparation, which, after being experimented with, resulted in the incandescent mantle in its present form. The discovery of electricity as a means of illumination was almost coincident with the introduction of gas. In 1800, Sir Humphrey Davey conducted experiments which led to the production of the arc lamp, but on account of the high voltage necessary, and the then expensive method of generating electricity by means of batteries, its application for lighting purposes was greatly retarded. With the introduction of the dynamo-electric machine in 1867, a new era began, and after various improvements, the modern lamp was evolved by Edison. In the original lamps, a platinum filament was used; this was discarded in favour of carbon, but the modern adaptations had returned to the metal filament and were proving superior to carbon and gradually superseding it. Mr. Holmes, in referring to the almost universal adoption of gas for lighting, while electricity was still in its infancy, attributed it to the fact that in the case of the former, the tools necessary for its development were ready at hand, while the difficulties to be overcome in the application of electricity were illustrated when it was considered that the principle of the carbon filament lamp was known forty years before the proper vacuum could be obtained, which was at last achieved by the Sprengel pump. The cost of supplying electricity was the chief objection from the beginning, but that objection was being overcome. At one time the price in some instances worked out at 2s. 6d. per unit; it was afterwards fixed by Parliament at 8d. per unit, and to-day, the price in West Ham was 3d. per unit for lighting and 1d. per unit for power, the difference between these two latter amounts was due to the capital charges for generating being in the ratio of nearly three to one. During the last two or three years, the "Tantalum," the "Osmiert," and later still the "Osram" lamps had successively brought down the cost to the consumer until a saving of nearly three-quarters of the former amount could now be effected. The "Nernst" incandescent mantle was expected to do for electricity what the Welsbach mantle had done for gas, but the short life of the mantle prevented it being a commercial success. The tendency in modern practice was to revert to the original arc lamp. The flame arc lamp was now being used with great success, especially for street lighting, and gave four times the power of the ordinary open type for the same consumption, but, unfortunately, it could not easily be made as a small current lamp. Another objection to the flame arc was the expense of renewals, but an improved type was now being made, the Regenerative arc lamp, which would have the effect of prolonging its life from ten hours to seventy hours. Demonstrations were given showing the light and ampèrage of various types of lamp, with carbon and metal filaments, also the ready application of electricity to kettles, flat-irons and other household appliances. A lamp was also shown, the base of which became magnetic on the current being switched on, making it especially suitable for use in works for repairing or overhauling, where it could be fixed to iron or steel in any position desired by the user. Comments were made by Messrs. W. P. Durtnall, Jas. Adamson, J. H. Redman and W. Britton. Mr. G. W. Newall proposed and Mr. W. E. Ross seconded a vote of thank to Messrs. Battle and Holmes.

THE SCREW PROPELLER.

XVII.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

Number of Blades.

The original screw of F. P. Smith had virtually only one blade, inasmuch as there was only one convolution of a helix. The second screw was only half the length of the first, but it had the parts of two helices, and hence was a two-bladed instrument with the same acting surface as the first one. It was, however, now in balance at every part, and consequently it ran without the violent vibration experienced with the original when at high speed. The word blade, however, cannot have been an appropriate term for the acting parts of such screws as these, nor could it have been applied properly till the length of the screw was cut down to one-eighth the diameter, so that the form on each side of the boss did then somewhat resemble the blade of an oar. So long as screw steamers were fully rigged and supplied with canvas enough to navigate easily under sail, the two-bladed screw was desirably, if not absolutely, necessary, so as to offer the least resistance by housing the blades vertically behind the sternpost, or, better still, by raising the the screw out of the water altogether; for this reason the two-bladed screw remained in general use in the Navy down to 1875, and was even common so late as 1885, whereas in the mercantile marine the screw with three and four blades became the rule in the early sixties in spite of the ships being then fully rigged and making use of their sails as late as 1890; but whereas the warship often made quite long runs under sails alone, it was quite a rare thing and only on special stations, as the Pacific, for a merchant steamship to do so after 1865.

* For Articles I. to XVI., see previous issues.

The Naval Authorities were not blind to the advantages of three and four-bladed screws, for they made several interesting experiments with them, and went further and tried the effect of increasing the number of blades even to as many as six. The general conclusion come to in those days was that the four-bladed screw gave as good, if not a better, speed than the two-bladed, and the vibration with it was much less, but the requirements of the Service rendered the latter necessary, and the advantages were luxuries the warship could not afford.

The first experiments made in H.M. Navy with screws having more than two blades was with the line of battleship *Duncan* (already described on page 123 *ante*) in 1861, when a series of trials were made at Stokes Bay with a Griffiths, a two bladed, a common screw with three blades, a feathering screw of Maudsley's design with two blades, and the original three-bladed common screw with its leading corners cropped so as to approximate to the Griffiths in shape with results as shown on Table XXIV.

TABLE XXIV.

Trials of H.M.S. "Duncan," 3985 tons in 1861, with Propellers differing in the Number of Blades.
Engines by John Penn & Sons, having Two Cylinders, 82 ins. Diam. and 48 ins. Stroke.

Particular Screw	Griffiths' Patent Screw	Maudslay's Feathering	Common Screw	Common with Cropped Leading Angles.
Diameter of Screw ... ft.	19·30	19·0	19·1	19·1
Pitch do. ... ft.	27·0	27·80	27·83	27·83
Number of Blades ...	Two	Two	Three	Three
Surface do. ... total sq. ft.	77·6	56·0	115·2	107·8
Pitch Ratio ...	1·400	1·453	1·453	1·453
Surface do. ...	0·267	2·00	0·401	0·376
Revolutions per Minute ...	60·5	58·0	54·0	55·0
Speed of Ship ... knots	13·338	13·162	13 322	13·289
Slip of Screw per Cent. ...	17·22	17·22	10·142	11·99
Indicated Horse Power ...	3341	3320	3167	3217
Do. Thrust ... L.B.S.	67,500	68,000	69,670	69,040
Calculated do. ... „	44,320	41,900	43,890	42,700
Resistance of Ship ... „	40.900	39,800	40,700	40,500
Net Ind. H.P. ...			1966	1899
Propeller H.P. ...			1796	1741
Resistance H.P. ...	1677	1609	1665	1647
Displmt.$^{2/3}$ × Speed^3 ÷ I.H.P. ...	176·2	172·6	187·6	183·3

It will be seen that the best result obtained with all these propellers, as judged by the magnitude of the Admiralty co-efficients, was when using the three bladed common screw, and it may be noted that the same screw when cropped was only slightly behind it in successful performance. Unfortunately in these trials there was considerable divergence in the number of revolutions made by the engines with the different screws; for, whereas the three-bladed screw had such a pitch that only fifty-four revolutions gave full speed. in the case of the Griffiths when the pitch was so much smaller, at the same time that the surface was also so much less, the engines were permitted to run sixty revolutions; hence, while the gross I.H.P. of the Griffiths was 9 per cent. higher, the net or effective H.P. was really not in excess; but, in spite of this, the Griffiths gave a slightly higher speed. Had this

trial, however, been in rough water, the result would probably have been very different.

The next experimental trials with the same object in view were carried out on the Solent in 1862 on H.M.S. *Shannon*, a frigate of 3,612 tons displacement. This time there was a larger variety of propellers, but the screws with more than two blades were made with increasing pitch on Woodcroft's plan. By the same criterion as before (Admiralty co-efficients), it will be seen that the Woodcroft four bladed screw gave the best results, but running it very close was the three-bladed. In these experiments, however, the fatal mistake was made of fitting the screws with blades of the same size in each case, so that the six bladed had double the surface of three bladed, and 50 per cent. more area than the one with four blades. In these trials, as in those of the *Duncan*, the difference in speed with the different propellers was only slight, the highest being 11·55 knots, and the lowest 11·208 with the six-bladed screw. Again, however, the very disturbing element or difference of engine revolutions was present in a pronounced form, for whereas the two-bladed common screw permitted of 58·88 revolutions being run with the engines, that with the six-bladed had so large a surface that only 49·67 were possible: so that although the two-bladed is debited with 2,057 I.H.P. against 1,956 I.H.P. of the six-bladed, the latter had 1,534 effective H.P. imparted to it, or only twenty-five less than the two-bladed got.

In 1863 a further set of trials was made with another frigate, H.M.S. *Emerald*, of 3563 tons displacement, in Stokes Bay, when screws of the same diameter

TABLE XXV.

Trials of H.M.S. "Shannon," 3612 Tons, in 1862, with Propellers Differing in the Number of Blades. Engines by John Penn & Sons.

Particulars of Screw.	Common Screw	Mangin's Patent.	Increasing Pitch	Increasing Pitch.	Increasing Pitch.
Diameter of Screw ....ft.	18·10	18·00	18·15	18·15	18·15
Pitch do. do. ....ft.	23·75	24·1 to 26·0	22·75 to 24·4	22·7 to 24·7	22·8 to 24·4
Number of Blades	Two	Four	Three	Four	Six
Surface do. ....Total sq. ft.	71·2	113·6	86·4	115·2	172·8
Pitch Ratio	1·312	1·444	1·345	1·367	1·345
Surface do.	0·272	0·440	0·334	0·446	0·670
Slip per cent.	17·79	17·42	14·89	10·83	6·34
Revolutions	58·58	53·17	56·08	53·17	49·67
Speed of Ship ....knots	11·288	11·33	11·492	11·55	11·208
Indicated Horse Power	2057	2033	2055	2023	1956
Do. Thrust ....lbs.	48750	48700	50000	50800	53200
Calculated do. ....lbs.	34276	35180	34220	35250	39600
Resistance of Ship....................lbs.	24225	24396	24080	25346	23845
Net I.H.P.	1559	1581	1579	1571	1534
Displacement $^{2/3}$ × Speed^3 ÷ I.H.P.	164·6	168·4	174·6	179·3	169·5

TABLE XXVI.

Trials of H.M.S. "Emerald," 3563 Tons in 1863, with Different Propellers and Number of Blades. Engines by Miller, Ravenhill & Co.

Particulars of Screw	Common Screw.	Increasing Pitch, Woodcrofts.	Common Screw.	Common Screw.
Diameter of Screw ....ft.	18·00	18·04	18·1	18·0
Pitch do. do. ....ft.	28·0 True	28·0 Mean	26·0 Mean	26·0 Mean
Number of Blades	Two	Two	Four	Six
Surface do. do. ... .Total sq. ft.	82·80	83·00	99·0	103·0
Pitch Ratio	1·556	1·555	1·440	1·444
Surface do.	0·326	0·325	0·388	0·405
Revolutions per Minute	53·83	53·17	53·33	51·50
Slip per cent..	22.49	21·55	12·28	11·26
Speed of Ship ....knots	11·530	11·525	12·003	11·726
Indicated Horse Power	2228	2249	2323	2124
Do. Thrust . ...lbs.	48800	49840	55300	52300
Calculated do. .... ,,	36200	34030	36500	34700
Resistance of Ship .... ,,	26590	26580	28800	27500
Net I.H.P. .... ,,	1690	1717	1790	1609
Displacement $^{2/3}$ × Speed^3 ÷ I.H.P.	160·80	158·8	171·7	175·1

as those in H.M.S. *Shannon* were tried with common blades, and having aggregate surfaces more in accordance with the requirements of the several cases. Two screws having each two blades, one of the common kind and one on Woodcroft's increasing pitch system; the third screw was a common one with four blades, having a mean pitch of 26 feet as against the 28 with the two-bladed ones; while the fourth had six blades with a surface of 103 sq. feet instead of 172·8 sq. feet of the six-bladed screw of the *Shannon*; but it was set unfortunately to a mean pitch of 26 feet instead of a trifle less, to compensate for the larger surface. The variation in revolutions was, however, not great in these trials and hardly a disturbing element. It will be seen that the four-bladed screw produced the highest speed, and that with an Admiralty co-efficient very little below that of the trial with the six-bladed screw, although the speed of the latter was a quarter of a knot less. It is noticeable in passing that the common screw of exactly the same dimensions as Woodcroft's beat it, as also that in both cases the slip was excessively high, being 22·49 per cent. with the common screw as against 12·28 per cent. with the four-bladed.

On the whole the two-bladed screw was not so very much inferior to those with more blades to warrant the giving of it up; while, on the other hand, it was probably clearly seen that the four-bladed was the better instrument, for had the trials been general and on the open sea the differences would have been much more marked and the difference in vibration would have been equally magnified. As it was, the two-bladed fitted in H.M. ships was soon after always on Griffiths' improved pattern and of a diameter and pitch as well as surface more in accordance with the real requirements. But following these experiments a considerable number of our largest ironclads were fitted with four-bladed screws, but as they were all of varying pitch (on Woodcroft's plan) and with wide tips to the blades as well as of large diameter, they were not so successful as the two-bladed Griffiths; and moreover they almost invariably ran with considerable negative slip and vibration.

To-day two-bladed screws are occasionally seen on very small craft confined to smooth water limits, when they are quite efficient and convenient, in fact probably more so than if with a large number of blades. The two-bladed feathering screw is also to be found on yachts which are intended to make long cruises under sail, and in parts of the world where coal is scarce and dear. The two-bladed screw, fitted in a banjo frame, which can be raised above the water line and even taken on deck, is now seldom met with, although by this method the screw is completely withdrawn from the water, and so forms no obstruction and does not affect the steering. In the case of Arctic exploring and whale-ships, such a system permits of the removal of the screw from the action of floating ice whereby it might be damaged or even destroyed.

The propeller with three blades is on the whole the most satisfactory one for general purposes, for whether it be working deeply or even thoroughly immersed, or be so near the surface as to induce air currents, it is as efficient as any other screw, and better balanced against vibration than those screws having their blades opposite one another. Moreover, a blade of sufficient breadth can be obtained with a three-bladed screw to ensure high efficiency without its having excessive surface. On the other hand, it may be argued that in case of a loss of one blade a reduction of 33 per cent. of its active service has taken place, while with a four-bladed screw under such circumstances the loss would be only 25 per cent. But when it is remembered that the thrust varies as the square root of the surface, the difference will be as between the 75 and the 67, or 3·75 per cent. instead of 8·30. The same argument applies when comparing the action of a three-bladed screw with the four-bladed in a seaway when the whole or the greater part of one blade may emerge and cease to resist. But as in practice for the same power, revolution, etc., a four-bladed screw has an aggregate acting surface larger than that of the three-bladed, and as all ships, especially those with single screws, are liable to pitch heavily and so expose their propellers, for ocean work or even ordinary open sea work, the four-bladed commends itself and is the favourite with all mercantile engineers. With twin-screw ships of all sizes things are somewhat different. They are generally of high speed and have the propellers well immersed; they run at high revolutions so that surface friction and other resistance of the screw is large; hence in favour of the three-bladed the arguments are conclusive, while the objections are not serious; and as regards the loss of a blade, it is in this case only the reduction by one-sixth the acting surface.

It will be seen therefore that the best number of blades to have on any one screw is determined by the conditions surrounding it, and the requirements of each particular case. There may be found in good practice screws with two, three and four blades, but from the experiments which have been made with screws having five and even six blades, there seems to be no advantage in such excessive numbers.

London Dumbartonshire Association.—At the annual meeting held in the Holborn Restaurant on March 20th Professor Cormack occupied the chair and presided over a pleasant gathering of Dumbartonians and their friends. Business being disposed of, social fellowship became the order of the evening, and in the course of the proceedings a telegram was received from the annual meeting of the Institute of Marine Engineers, expressive of kindly greetings and announcing the election of Mr. Jas. Denny as president. A return message was despatched to the Marine Engineers, reciprocating the good wishes on the part of the members of the Dumbartonshire Association.

The Franco-British Exhibition buildings are well in hand at Shepherd's Bush, and the arrangements bid fair to result in offering to the general public a very attractive visiting place during the summer months. Success should crown the efforts of the promoters in respect to all the objects in view: cementing of friendship between nations, illustrating the methods and manners of various countries, showing materials produced or manufactured in different lands, providing recreation for visitors supplying accommodation and encouraging conferences, lectures and papers on subjects of general and special interest; and covering the outlay by receiving full and abundant patronage from sellers, buyers and visitors alike. We note that in connection with the Institute of Marine Engineers a paper by Mr. W. P. Durtnall is proposed for an evening during July, on "The generation and electrical transmission of power for main engine propulsion and speed regulation," and for an evening during September a lecture by Mr. J. T. Milton on metals. Both of these subjects are sure to draw good audiences.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Disasters.

The Union Castle Company have sustained a serious loss in the stranding at Port Durnford, Richard's Bay, of their fine intermediate steamship *Newark Castle* when on her voyage to Delagoa Bay. The *Newark Castle* was a twin-screw vessel, built some six years ago by Messrs. Barclay, Curle & Co., of Glasgow, and was of upwards of 6,000 tons gross register. After going ashore there seems to have been no chance of saving the ship, as almost immediately it was reported that she was full of water and settling down on the rocks. Some baggage, the ship's papers and chronometers have been rescued, and amongst other things got out of the ship was a valise of some public importance, since it contains the papers relating to the defence of the island of Mauritius. These were recovered intact, but damaged with water, and it is evident from all accounts that the condition of the ship—which lies in the surf with the seas sweeping over her, is quite hopeless. One satisfactory feature of the case is the strong testimony which has been given to the order and discipline of the crew, and that by a high military authority, General Dalton, who was a passenger by the ill-fated vessel.

On the 26th February there stranded near Tobermory a steam trawler named the *Crane*. The press, which does not usually notice any of the far too numerous accidents to steam trawlers, chronicled this occurrence and mentioned that this was the famous vessel which was the subject of the outrage by the Russian Baltic fleet in the North Sea on the 22nd October, 1904. It was, of course, entirely wrong in making this statement. The vessel attacked by the Russian sailors was made an end of then and there, being sunk by the fire of the warships. But that vessel was the steam trawler *Crane* of Hull. The trawler which has just stranded at Tobermory was a newer steamer built as recently as the year 1902, and her port of registry was Grimsby.

La Compagnie Générale Transatlantique.

I am pleased to learn that, in spite of the competition of foreign lines and the increased sailings of passenger steamers from French ports, the old Compagnie Générale Transatlantique had a prosperous year in 1907 and is enabled from its increased net earnings to declare a dividend substantially higher than that for the year 1906. The effect of the fast and up-to-date steamers which it has of late added to its fleet for the maintenance of its various services—on the Mediterranean as well as on the Atlantic—has evidently begun to show its effect on the trade, and no doubt we shall see—unless general conditions become adverse—that the improvement now noted will be continued.

It has more recently been reported that encouraged perhaps by the success of last year's operations, the company has in contemplation the construction of a high-speed mail steamer which will surpass even its present fast vessels *La Provence* and *La Savoie*. The report can hardly refer to *La Picardie*, which is already building. For the proposed vessel is said to be intended to be of as much as thirty thousand tons in gross tonnage and to be designed for a speed of 25 knots. The yard at St. Nazaire is no doubt quite capable of turning out such a vessel—which would give France the pre-eminence over Germany in speed on the Atlantic. But if La Compagnie Générale is at all like certain of its big rivals the proposed vessel may be at the contemplated stage for a good many months, if not for years, to come.

By the way it is well to record that a famous link connecting the present of the great French company with its early days has been severed by the recent death of Monsieur Eugene Perière, one of the founders of the line and of recent years its honorary president. The prosperity of the French line brings into stronger relief

The Unfortunate Trading of the German Companies

in the year 190[illegible], the great Hamburg-American Company, which paid 8 per cent. to its shareholders on the operation of the year 19[illegible], reduced its dividend to 6 per cent. for the year whose statement has recently been issued. Its report attributes this unfavourable result to the fact that there have been several rate wars which, in various sections of the company's activity, have seriously affected its earnings. Not only has trade slackened off all over the world, but the company has been called upon to contend with labour troubles at certain of its more important ports. Considerable economies are now being effected to meet the situation. The much-talked-of leviathan, which was to surpass the new Cunarders in bulk—even if she was not to attempt any rivalry in speed—is not to be built just yet awhile, it being stated that the financial crisis in the United States has had the effect of so reducing the volume of passenger traffic on the New York line that the present vessels, *Amerika* and *Kaiserin Augusta Victoria* are quite capable of dealing with all the traffic *de luxe* which comes the company's way at present. Further, a large number of vessels are being laid up at Hamburg, and sailings are being reduced in various directions. In the year under review one of the events to which the directors attach especial importance is their agreement with the Woermann line in respect of the trade to West Africa, and one cannot help feeling that this union of forces by German shipping interests may have a sinister effect on the future of certain well-known British lines which make the Mersey their headquarters. The enormous extent of the undertaking over which Herr Ballin so ably presides is well indicated by some of the figures quoted in the report. The tonnage of the fleet amounts to no less than 955,742 tons, though the increase for the year is by no means large. The average age of the ships is under eight years. But satisfactory as this figure is, it should be accepted with two mental notes. The company has of recent years added very largely to its capital, and that new capital should necessarily be represented by new tonnage, whilst the advantage taken by those interested in the company's success of Russia's difficulties in the Japanese war enabled the directors to dispose of much old shipping at very lucrative prices. The number of round trips performed by the fleet in the year was 1228 and the distance covered amounted to some $7\frac{3}{4}$ millions of miles.

The report of the Nord Deutscher Lloyd is even less satisfactory than that of the Hamburg line. Perhaps the worst that can be said is that whilst the Hamburg Company's operations involved no transfer of balance between it and the Combine, the latter will have to pay something to the N.D. Lloyd under the agreement for the partial equalization of dividends. The return to the shareholders for the year has, in fact fallen from $8\frac{1}{3}$ per cent. in 1906 to $4\frac{1}{2}$ per cent. in 1907, the net earnings having dropped from $12\frac{1}{4}$ millions of marks to not much over five and a half millions, and that, it should be observed, at a time when not inconsiderable additions have been made to the capital on which returns have to be made. The balance sheet is further unsatisfactory in one or two other points, the reserves not being quite as large as a year ago, whilst the depreciation seems to have been lessened.

The Hanseatic Steamship Company, of Hamburg, has paid no dividend to its shareholders, and there is talk of disposing of the undertaking. On the other hand, the Hansa Steamship Company presents a most satisfactory story. Its earnings have increased by nearly two millions of marks and the return to the shareholders is increased from 6 to 8 per cent. for the year.

A New Atlantic Passenger Line.

On the 21st March the New York and Continental Line, which for some time has been maintaining a cargo line on the Atlantic, made its first despatch of a steamer in its new passenger service. For this development it intends to have a fleet of five vessels of about 14 knots ocean speed. Three of these are already in its hands. They are the *Volturno*, a new steamer, which opened the service, and the *Avoca* and *Jelunga*, formerly of the British India Steam Navigation Company's fleet. The two remaining ships are not yet completed. The idea is to maintain a fortnightly service from Hamburg and Rotterdam on this side, to Halifax and New York. The vessels will carry passengers of every class and the fares seem to be lower than those fixed by the conference the steerage rate being but £4 12s. The managers of the line are Messrs. Petersen, whose name has been known for some years in the steamship world, especially, if my memory fail me not, in connection with the trade to the St. Lawrence.

Some little fuss

is being made about a proposed training scheme for officers which it is said the White Star Company is evolving. One shipping journal has proclaimed that Mr. Bruce Ismay has obtained from the Board of Trade special regulations to enable

him to carry his idea into effect. So far as the evidence at present available goes he has done nothing of the kind, and I am sure that those who are at the head of the Marine Department of the Board of Trade are far too wise and just to make any distinction between one shipowner and another. What has been done seems to be this. Mr. Ismay, like many other shipowners, no doubt finds that the duties and responsibilities of officers are changing as the type and employment of steamships alter, and probably even a company of the standing of the White Star line finds that the complaints of the shortage of junior officers are not altogether unfounded. True it may be that there are always plenty of men who are desirous of joining the White Star service. But they may not be altogether of the material and experience which the company desires. Moreover, the training at present open to junior officers is not quite adapted to the requirements of the day in big liners. At all events the Board of Trade have issued certain special regulations as a sort of explanatory supplement to the 1904 edition of the regulations controlling the examination of masters and mates for certificates under the Board of Trade. The special regulations now issued apply to the establishment—either by Mr. Ismay or by any other shipowner—of a training ship for cadets. After four years' service therein—or less if the candidate be a Conway or Worcester boy—the Board of Trade examination for his second mate's certificate will be open to him. The admission to the examinations for the next steps in his career will be regulated by the service in which he has been engaged, and the new regulations are framed in view of the practice as to watch-keeping in large modern steamers, work in vessels of over 8000 tons gross register and at least sixteen knots speed, where there is a minimum of six deck officers and a crew of 130 men, being the standard. These regulations may facilitate the development of the class of junior officer required, either by Mr. Ismay or by any other shipowner whose fleet contains steamships of the type referred to in the regulations.

The Great Eastern Railway Company

are evidently fully satisfied with their new steamship *Copenhagen*, whose advent to their fleet I mentioned last month. There had been certain rumours flying about as to the possible order for another turbine steamer of the same class as she, but nothing definite had transpired. There is now an official statement, however, to the effect that a new vessel, sister to the *Copenhagen*, has been ordered by the Railway Company for the Hook of Holland service from Messrs. John Brown & Co., of Clydebank, who, of course, are the builders of the vessel which is now making for herself a reputation in the company's service from Harwich.

The Isle of Man Steam Packet Company,

too, is satisfied with the value of Mr. Parsons' invention. They have had thorough opportunity of testing it in the working of their favourite passenger steamer *Viking*, and now they are adding a still larger and faster turbine-engined ship to their fleet. This is the new *Ben-my-Chree*, which was launched at Barrow from the yard of Messrs. Vickers, Sons & Maxim on the 23rd March. She is a huge example of the steamship of the narrow seas, being capable of carrying no less than 2500 passengers—a total which she is likely to reach often enough, if we have fine Augusts. She has five decks—the promenade deck extending two thirds of the ship's length, and for one-half her length having the shelter of a boat deck above it. The steamer has been built with a view to insuring safety in every possible direction, and is classed to Lloyd's highest standard. Her dimensions are 375 ft. B.P. and 390 ft. overall with a beam of 46 ft. and a depth of hold of 18 ft. 6 in. Her speed is to be no less than 25 knots, which will be an increase of some 2½ knots on that of the successful predecessor *Viking*. It is evident from this fact that the directors of the progressive Manx Steamship Company are of opinion that speed pays, though the passage is already so short that one would think that passengers had little enough opportunity as it is to take note of and appreciate the comfort and luxury which is provided for them in these vessels. Ben-my-Chree is, I believe the name of an ancient Manx King. The name is, however well known to those who are acquainted with the service, as for many years it was borne by a passenger steamer of the line recently broken up. She, like the present ship was built at the Barrow yard, and her details may be noted as showing the change which the progress of thirty three years has brought about. Built in 1875 she was an iron paddler of 1031 tons gross register, her length being 310 ft. between perpendiculars, with 31 ft. beam and 13 ft. depth of hold. She was certified to carry 1030 passengers. I fancy her speed did not exceed 16 knots. Apart from the immense increase in speed, perhaps the most remarkable point is the way in which the beam of the new ship is fifty per cent. greater than that of the older vessel, whilst the length has not been so materially added to.

The Manx Company has been much exercised recently as to the question of Sunday sailings. The Manx are an essentially religious people and are strict observers of the Sabbath. No Sunday sailings have ever been encouraged. That was all very well in the days when I first knew the island for at that time there were but three departures a week in the winter months. Now there are often more sailings than that in a single day in the season, and it seems hard that opportunity for movement should be refused to those whose engagements compel them to terminate their brief holidays on Sunday. So a poll has been taken of the shareholders of the company with a view to ascertaining their views on the Sunday question. So far as I have been able to learn two questions were put to the voters: First, what their own views on the question might be, and secondly, whether they wished those views to be carried into effect or whether they would prefer to allow discretion to their directors. A small majority of shareholders seems to have been personally opposed to Sunday sailings, but wisdom spoke in the overwhelming expression of opinion that the matter was one to be left to the management for decision.

Submarine Bells.

I had the pleasure of a little trip down channel in the Union Castle Line's intermediate steamer *Dunluce Castle* on the evening of the 27th February. It is an extraordinary thing that these trips are not more generally enjoyed by the jaded Londoner. He goes on board the steamer at Blackwall on the Thursday evening before dinner and lands at Southampton after breakfast on the Saturday morning, having not only had a pleasant time, but having had opportunity to forget all his troubles and to realize there something of the life in an ocean liner. In a vessel of 8000 tons, weather does not matter. It was bitterly cold on this trip, with heavy snow storms and a full gale on the Friday night. But not one of the passengers noticed these things—they were too busy enjoying the comforts of the ship—and there was certainly no suggestion of sea sickness.

To me the voyage was exceptionally interesting, as it afforded an opportunity of seeing something more of the details of the working of the new submarine bell, which I had already tried aboard the *Carmania* and the *Lusitania*. That the extension of the use of this aid to navigation will be of the utmost value to the seaman is no longer to be questioned. Had there been a bell at Lundy Island and a receiving apparatus in use aboard H.M.S. *Montagu* we had certainly had a battleship the more under the White Ensign. In the *Dunluce Castle* there was opportunity off the Tongue and down the Goodwins of hearing the bell in a somewhat restricted area, and the effect of the banks on the waves of sound passing through the water was somewhat noticeable, though it may be accepted as certain that the presence of these banks in no way detracts from the value of the signals given. Indeed, the experience seemed to show that in such waters the bell gives indications to those who study their chart and know the neighbourhood, other than the mere fact of the direction of the source of the sound.

The New Cunarders.

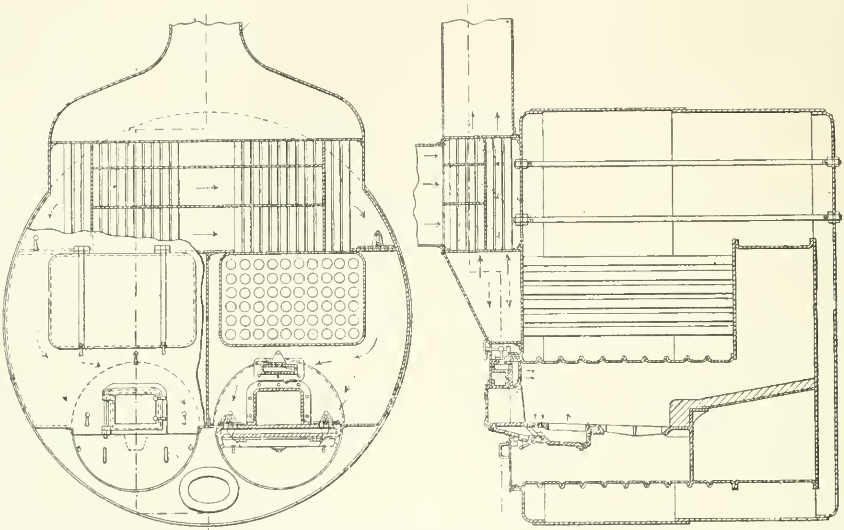
Their three weeks in dock has shown its effect on the new Cunarders, and the Government was undoubtedly right in providing for the payment of the agreed subsidy to them, even if as yet in these cruel winter months, they have not had the opportunity of showing how much they are capable of exceeding the guarantees that were made for them ere their keels were laid.

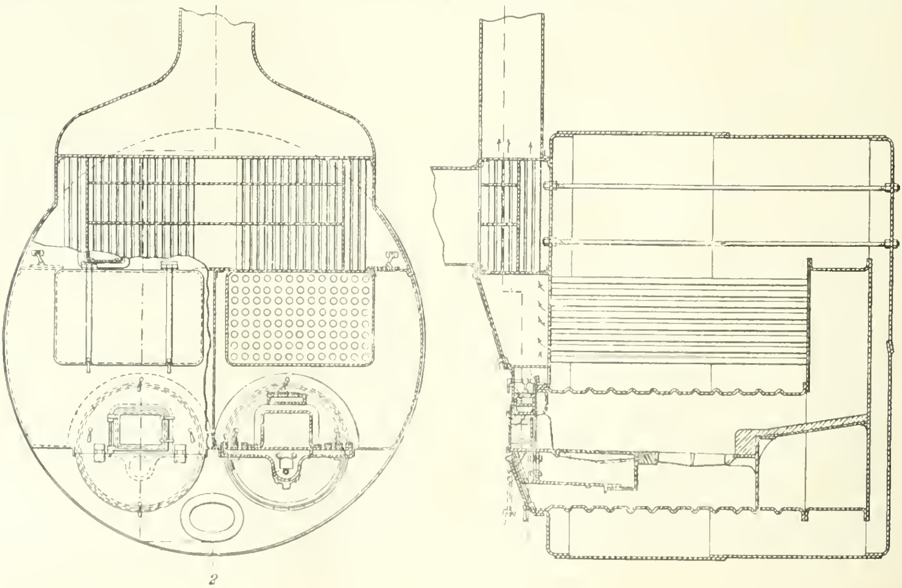
The *Lusitania* on her outward run after her rest, made 627 miles in a single day—of course lowering all records—even those of herself and her sister—the speed being 25·14 knots—a good knot better than the *Deutschland's* somewhat doubtful best performance. That was to noon on the 10th March. Meanwhile the *Mauretania*, bound the other way, was making the record for average speed on a whole voyage, getting as high as 24·42 knots over the whole Atlantic course.

A SYSTEM OF FORCED DRAUGHT WITH NEW FEATURES.

THE introduction of forced or induced draught to marine boilers some twenty years ago was not hailed with universal acclamation on account of troubles which occurred in several steamers so fitted, due to fire-box plates buckling, and the fears entertained as to the furnaces collapsing with the fierce heat.

At the present day the scruples and fears have vanished and forced draught is accepted as the modern system for marine boilers, and with it most new steamers are fitted. The system now requires no advocates. This being assumed, the question of improvements on the usual system becomes a factor of





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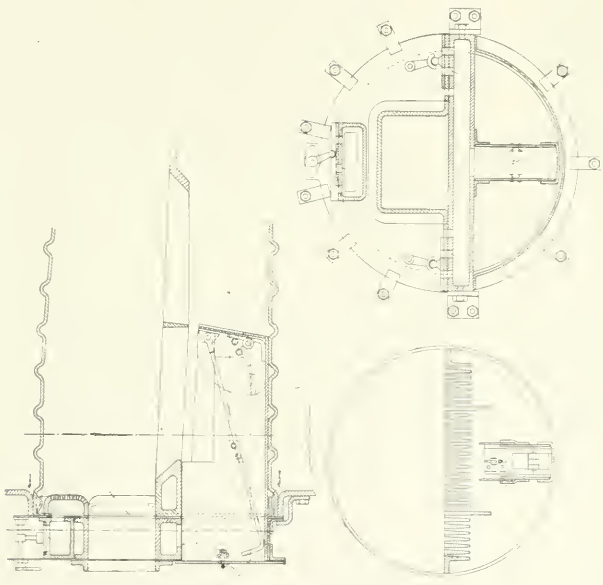
importance and value to all marine engineers, and that it is so considered may be stated from the references to, and discussions we have heard on the subject, both around the mess room table and in the reading room or lecture hall sacred to such technical matters. Mr. Jas. Macdonald Stratton has evolved, as the result of observation and experience of forced draught, a system, which, although substantially the same as those in general use, has some special features, claimed to be improvements in the direction of efficiency and economy. There are two principal aims in the system referred to: a better arrangement of heating the air and at the same time utilising more of the otherwise waste heat from the products of combustion.

From the air-heating chamber the air passes through the openings at the ends of the chamber, into an air casing fixed in front of the boiler, from this air casing air passes through valve-controlled openings into the front of the furnace, whence it is distributed through perforated baffle boxes over the front of the fire. From the air casing, air also passes through valve-controlled openings into a horizontal chamber fixed in front of the furnace. From this horizontal chamber air passes through an opening in the centre of the chamber into a chamber fixed along the whole or part of the length of the ash pit.

The front of this chamber is closed either by the ash pit damper or by a separate damper or plate; the



Improved forced and induced draught arrangement

With this object an air chamber is fitted in the uptake, containing vertically-placed tubes through which the gases pass on the way to the funnel. So far this is similar to Messrs. Howden's system, but in addition to the usual arrangement there are division plates fitted to direct the current of the air in its passage to the furnaces. These plates are so fitted that the current of air is diverted and directed to obtain the greatest amount of heat from the tube-heating surface, one special object being to avoid the lessened effect due in the usual system in operation, when fires are being cleaned or not burning brightly. A reference to the illustrations will show the improvements which are claimed by the patentee, Mr. Jas. M. Stratton.

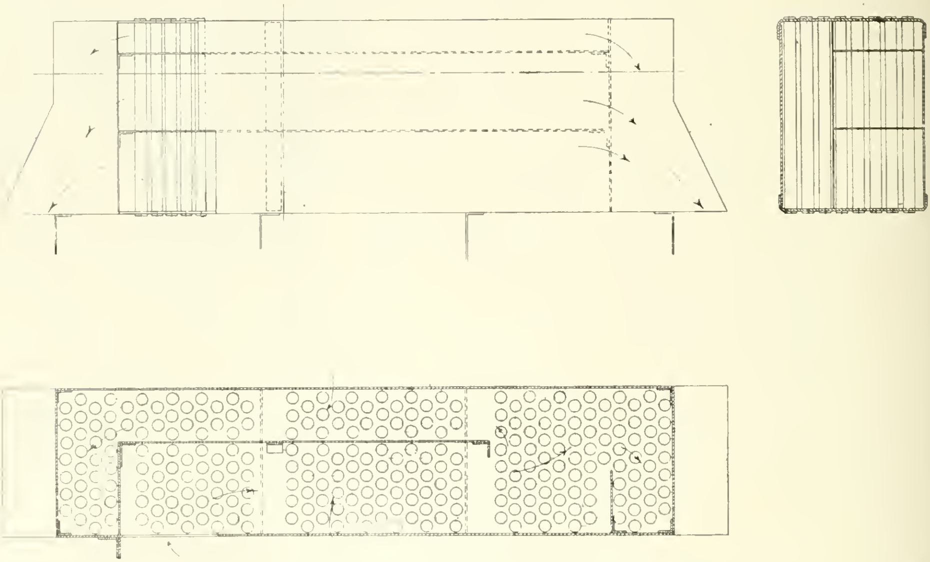
back or inner end may be closed by a damper fixed on hinges so that it can be raised or lowered as desired.

The air passes from the front end of the chamber over the walls of the chamber into the sides and back of the ash pit. The air passing over the walls of the chamber will keep them from being burnt, but extension pieces may be fixed on to the walls so that any burnt part can be easily renewed. In order to protect the furnace front on each side of the fire door, perforated baffle boxes or slabs of firebrick are placed, and in order to removably fix these boxes or slabs in position they are provided with grooves coacting with flanged plates or angle irons fixed on the inner wall of the furnace front. By fixing this open

top chamber in the front of the ash pit a much better draught is got through the front of the firegrate, on account of the air having to rise directly under that part of the firegrate.

If desired the side walls of the chamber can be carried through below the firegrate so as to form an independent chamber in the ash pit.

By means of this independent chamber the sides of the fire can be worked with a less air pressure in the ash pit than at the centre, and it prevents the whole or greater part of the air that is conveyed into the ash pit escaping through weak or uncovered parts at the sides of the firegrate without doing any useful work along the central line thereof. Instead of fixing a chamber along the ash pit, a corrugated or plain plate may be fixed longitudinally along the centre of the ash pit. On the front end, or it may be in front of this longitudinal plate, a transverse plate is placed so as to form a recess in which the air along the sides of the longitudinal plate is sheltered from the velocity of the incoming air and so is allowed to rise freely up through the firegrate. This modification should be used with either an open or closed ash pit.



Air Heater. A system of forced draught with new features.

REVIEWS.

Technical Dictionary in Six Languages. Vol. II. Electrical Engineering (…). London: Constable and Co. 1908.

The six languages are German, English, French, Russian, Italian and Spanish, the columns being vertical, two on a page, and the articles represented graphically between these columns. It is possible, therefore, at a glance, to obtain the meaning of an article in six languages and have it illustrated at the same time, where possible. It is obvious, therefore, that we have here an educator and useful book at one and the same time, and in these days, when technical work has reached such a high pitch there can be no question of the utility of such a method. Though the illustrations are not large, they are very clear and readily comprehensible. It remains to give the sections into which the work is divided, which embrace every department of electrical work, including units of measure and electro-physics. An alphabetical index of five languages first shows the page in which each word is found and the same is done for Russian separately. This is a remarkable compilation and contains 2000 pages in a very small compass.

Simple Problems in Marine Engineering Design. (2/6). By J. W. and R. M. Sothern. Glasgow: Jas. Munro & Co. 1908.

This little work is divided into sections, each of which comprises a department of the subject of design. The system adopted is to commence with a rule which is clearly stated and the problems set follow from this rule. The sections are six in number and from simple calculations lead up to engine, boiler and marine turbine design, followed by speed calculations and other problems. The student must commit the rules to memory and work his problems out from these rules, and though of great value so far as it goes and probably sufficient to enable a pass to be made, there is here very little attempt to explain the rules. The compass of the book would not perhaps permit it. Coming to details, the problems are from the beginning made to suit the aspirant for Board of Trade examinations, and simply told to suit the average understanding. The book would be an aid also to teachers for these examinations. The questions on steam turbines are likely to be of interest, but as there is little or no reasoning, and merely the statement of rules followed by questions, it is difficult to speak strictly on what we find. If the problems are actual results of practice, they must be of certain value, but as we said at the outset, the utility of such a work as this is limited to candidates for examinations and that is all, probably, the authors desire.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

The new vessel allotted to us is to be an improved *Dreadnought*, but she will not be begun until about December, as only £138,891 is to be expended on her during the financial year ending on March 31st next. Of this amount, £17,385 will be for labour, while on the *Bellerophon* and *St. Vincent* the wages bills are estimated at £75,280 and £117,695 respectively. Not many refits appear in the Estimates, but there are usually more than anticipated during the year. Those allowed for are the battleship *Prince George*, the flagship of the local division of the Home Fleet, £11,475; the cruiser *Terrible*, which has been in hand some time having a new shaft fitted, £66,771; the cruiser *Berwick*, £41,461; and the cruiser *Forte*, £13,983. Then there is Torpedo-boat No. 047, upon which £12,947 is to be expended. With regard to new works, about £141,000 is to be spent, of which £65,000 is for beginning the new lock, which will cost altogether a million sterling; £7,000 for harbour protection (the breakwater across the Horse Sand Shallows); £29,000 for dredging; and £5,000—one-fourth of the full amount—for the new joiners' shop. According to the small amount allowed for the new lock it will be many years yet before the work is completed. Still, take the Estimates altogether, Portsmouth is provided for very well indeed. Both our new vessels are making satisfactory progress. The *Bellerophon* will be out of hand by December—it will be two years on the 3rd of that month since she was laid down. Indeed, it is confidently expected that she will be ready for sea quite a month before that time. Nearly all her machinery has been received, all her turbines are in position, as are also the two funnels and the mainmast. Building operations on the *St. Vincent*—£1,100,587 are to be expended on the vessel during the financial year—are proceeding very steadily. The stem and stern posts are in position, and although the sides of the vessel are not yet the proper height, a good deal of work in connection with the athwartship bulkheads has been done. Material is arriving daily, but as in the case of the *Bellerophon* no overtime is allowed. It has been announced that she is to be launched in August. The King's yacht, the *Victoria and Albert*, has had her refit completed and very spick and span she looks. The orders were that she was to be ready for the King's use by March 1st. It is now understood that the yacht will not be required until the summer, when the King and Queen go on a holiday trip to Norway and Sweden. Eight destroyers of the *River* class—the *Boyne*, *Gala*, *Ribble*, *Teviot*, *Usk*, *Waveney*, *Welland* and *Garry*—which have been in dockyard hands, left on March 3rd for the Nore to join the Permanent Flotilla for a cruise to the north. The two latter vessels have been painted grey. On March 8th, a mishap occurred to the torpedo gunboat *Spanker*, which left for Sheerness to join the Nore Division of the Home Fleet for its cruise. When passing No Man's Fort, Bembridge, her machinery broke down and a tug went to bring her into harbour, but when off Southsea Castle, the *Spanker* grounded on the sand. This was at seven o'clock on a Sunday evening, and all efforts to get her off were fruitless until three next morning, when she was brought into harbour and docked. During the salving operations, which were carried out in the teeth of a strong westerly wind and heavy rain squalls, two of the tugs also went ashore. The Commander-in-Chief at this port, Admiral Sir Day Bosanquet, left on March 23rd, and the same day his successor Admiral Sir Arthur Fanshawe, hoisted his flag. The retiring Admiral has not only left Portsmouth, but he has retired from the Service, having reached the inexorable age limit. He has, however, had one piece of good fortune, for he was employed every day that he was a full admiral. Many an admiral in these days passes on to the retired list without ever having hoisted his flag. The battleship *Canopus*, of the Home Fleet, has been taken in hand for an extensive refit, preparatory to going to the Mediterranean to relieve the *Irresistible*.

Sheerness Dockyard.

As far as Sheerness is concerned, the Navy Estimates for the new financial year are not at all interesting, for they contain nothing whatever with reference to the work of the yard. It is interesting to learn, however, that twenty-one destroyers are to be refitted at a cost of £143,479, and there is little doubt but that we shall have the lion's share. Work will be sure to be plentiful here, for as Chatham is to do the repairs to the large vessels, it does not appear as if they will be able to spare time to do many of the smaller craft at the up-river yard. Attached to the Nore there are about fifty destroyers, a submarine flotilla, and several torpedo gunboats, so if we have only those to keep in order we shall have more than enough to do, irrespective of any vessels which may be sent from the other yards or any odd jobs that may turn up. Torpedo-boat No. 23, which arrived last month, has been commissioned as tender to the *Blake*. She soon met with a mishap, for while berthed at a buoy in the harbour she had her stem twisted by the gunboat *Pembroke*, which steamed across her bow. The sloop *Rinaldo*, which has been converted for service as a tender to the Devonport Gunnery School, proceeded to that port at the end of February to enter upon her new duties. Nearly the whole of the month the harbour has been practically empty. On Thursday, March 5th, the cruiser *Topaze*, which flies the broad pennant of Commodore Bayly, the cruiser *Blenheim*, depot ship, the scouts *Attentive* and *Adventure* and the Permanent Flotilla of twenty-four destroyers left for a cruise to Scotland, anchoring for the week-end at Harwich. Twelve of the destroyers have been painted grey, the others remaining black. The following Monday, the Nore Division of the Home Fleet left for its cruise accompanied by four vessels of the Fifth Cruiser Squadron, the destroyer flotilla joining up at sea. The fleet consisted of the battleships *Dreadnought* and *Bulwark* (flagships), *Majestic* and *Cæsar*, six cruisers, three torpedo gunboats, the mine-laying vessel *Thetis* and the hospital ship *Maine*, which has been temporarily detached from the Mediterranean Fleet. The repair ship *Cyclops*, whose refit at Chatham was not quite completed, subsequently joined the fleet at Invergordon. And there are some people who imagine that our navy is not strong enough to protect us. Yet here we have only one division of the Home Fleet—in justice, it must be said that it is the strongest division—consisting of over forty vessels with the necessary auxiliary craft, the whole aggregating nearly 200,000 tons, all ready to "go anywhere and do anything." The Lords of the Admiralty, after carrying out their inspection at Chatham will come on here, but their visit will not be a lengthy one, as they are due to leave on April 4th. The destroyer *Myrmidon*, of the Portsmouth flotilla, has had her boilers retubed, and is to carry out a full-power trial in the North Sea on April 4th, after which she is to go on to Portsmouth.

Chatham Dockyard.

We are naturally somewhat disappointed that we are not to build a large vessel this year, although none but the most sanguine expected that one would fall to our share. However, we are not altogether ignored as regards new construction. Two more submarines are to be laid down, and, as in the case of the four vessels in hand, the propelling machinery will be made here. The amount to be spent on the new vessels during the financial year is £28,784, of which £4,300 is for labour, so it is not likely that they will be begun until late in the year. The four submarines in hand, C 17 to C 20 are allowed £144,759 of which £60,040 is for wages. The two tugs *Grappler* and *Rover* are to be completed during the year, the amount for labour on the two vessels being £2,410 and £6,150 respectively. The former is for Portsmouth and the latter for Devonport. The only other new work provided for is two lighters, the amount for wages on which is put down at £1,625. The refits, however, will give us plenty to do. The heaviest will be the battleship *Formidable*, now in the Mediterranean, upon which £64,800 is to be spent, £36,000 being for labour. Her sister vessel, the *Implacable*, on the same station, is to be refitted at a cost of £64,521, wages absorbing £34,900. The battleships *London*, of the Home Fleet, and *Venerable*, of the Channel Fleet, are to be refitted late in the year, the amount allowed for them being £10,303 and £10,245 respectively, £3,650 being for labour in each case. The vessels will not, however, be completed during the financial year. Then the cruiser *Gladiator* is to be sent round from Portsmouth for a somewhat

extensive overhaul, which is estimated at £20,365. Of work in hand, the cruiser *Blake*, which is being fitted as a depot ship for destroyers, is to have a further £20,130 spent on her, while the torpedo vessel depot ship *Vulcan* is to absorb £37,582, the wages on the two amounting to £41,530. The cruiser, *Diadem*, which has been in hand for some time, is allocated a further £38,763, of which the large sum of £22,050 will be for labour. The cruiser *St. George*, of the Devonport Division of the Home Fleet, is to be sent round here later in the year to be converted into a depot ship in the same way as the *Blake* is being converted, the amount allowed for the purpose this year being £16,705, of which £7,850 will be for wages. Therefore, taking it all round, we have a prosperous year to look forward to. The number of workmen in the yard, according to the latest return, is nearly 8,000, this being 1,000 more than a year ago. The battleship *Victorious* came up from Sheerness for her refit towards the end of February, the *Cæsar* having been sent round from Devonport to take her place in the Home Fleet. The battleship *Ocean* of the Channel Fleet has also come in. The *Cochrane* and *Warrior* have rejoined the Fifth Cruiser Squadron. The former, when anchored at the Nore on March 8th had her mast blown down during a south-westerly gale. The new cruiser *Shannon* was commissioned on March 10th as the flagship of the squadron in place of the *Leviathan*, which is in hand refitting. The latter vessel is to go round to Devonport to take up the duties of flagship of the Home Fleet at that port. On April 1st, "My Lords" are due for their annual inspection of the establishment, and they afterwards go on to Sheerness. A sale is to take place on April 7th, in which will be included the hulks *Asia*, *Akbar*, *Seaflower* and *Lily* and the coastguard vessel, *Frolic*.

Devonport Dockyard.

According to the Estimates we shall have a very busy year. True, we have not got another *Dreadnought* to build, it being understood that the "New Ship No. 2" is to be an armoured cruiser, an improved *Invincible*. On her, only £139,650—£20,000 for labour—is to be spent during the financial year commencing on April 1st. Therefore she is not likely to be laid down much before Christmas. By the time the new vessel is begun, the *Téméraire* should be ready for sea. Upon that vessel and the *Collingwood*, just over a million and a quarter is to be expended—£94,585 and £108,455 for labour respectively. The latter vessel will, it is expected, be ready for launching by the end of September. The first consignment of the 12-inch gun mountings for the *Téméraire* arrived on March 12th from Vickers', a few days after the guns came. There are several large refits—the cruiser *Hogue*, of the North American Squadron, £42,107; the cruiser *Niobe*, flagship of the local division of the Home Fleet, £47,857; the cruiser *Doris* of the Home Fleet, £18,434; and the cruiser *Pelorus*, £21,424. The latter vessel, which is on the Cape of Good Hope station, will not probably come home until October. The *Niobe* will cease to be the flagship at this port on March 31st, as on that day the *Leviathan*, which has been superseded as flagship of the Fifth Cruiser Squadron by the *Shannon*, is to be commissioned at Chatham as flagship of this division. Torpedo-boat No. 099 is to have £7,813 expended on her. This is the boat it may be remembered, which sank off Berry Head last June and was raised in two parts. The main portion has been in No. 4 Dock three or four months, while the stern part is on the side of the dock. It will be an interesting job fitting the two parts together, but it is questionable whether the vessel when completed will be worth the time and trouble expended on her. The battleship *Hibernia*, of the Channel Fleet, is undergoing a most extensive refit, including some very important additions and improvements to her magazine equipment and wireless installation, as also the overhauling of her fire-control instruments. The cruiser *Talbot*, of the same Fleet, came in on March 5th for her refit; while the battleship *Commonwealth*, another of the vessels under the command of Admiral Lord Charles Beresford, is due in May. The battleship *Cæsar* whose refit was not completed when the local division of the Home Fleet went for its cruise, proceeded at the beginning of the month to Sheerness to join the Nore Fleet for its cruise to Scotland. The cruiser *Minotaur*, having completed her trials satisfactorily, was handed over to the Admiralty officials at the end of February, and she is now being cleaned up and prepared for commissioning for service with the Fifth Cruiser Squadron, instead of the Second Cruiser Squadron, as at first expected. In order to get her ready by March 31st, about 250 casual labourers were entered. The cruiser *Doris*, of the Home Fleet, and three destroyers left for Queenstown on Sunday, March 8th, to take part in combined naval and military operations for testing the defences of the harbour. She did not arrive at her destination until Tuesday, having been compelled to seek shelter with the destroyers in St. Ives. The cruiser encountered terrific weather and lost some of her boats, while the destroyers took nearly four days on the voyage. A smart performance was accomplished by the cruiser *Donegal*, which has only a nucleus crew. On the afternoon of Saturday, March 14th, orders were received for the vessel to complete to full crew, embark stores, and proceed to sea to tow the cruiser *Medea* round to Haulbowline. Notwithstanding that a large number of men were away on week-end leave the *Donegal* was quite ready by ten o'clock on Sunday morning. On March 17th, the Fleet left for a cruise, making Berehaven the base, it being joined there by the *Doris* and *Donegal*. Our new Admiral Superintendent, Rear-Admiral Cross, is due on March 31st to take over the command from Vice-Admiral Barlow, an officer from whom we all part with regret. It is interesting to note that Mr. Tom Proctor, a local dockyardman, who unsuccessfully contested Grimsby as a Labour candidate at the General Election, has been invited to stand for three constituencies—Coventry, Glasgow and Ilkeston—at the next Election.

Pembroke Dockyard.

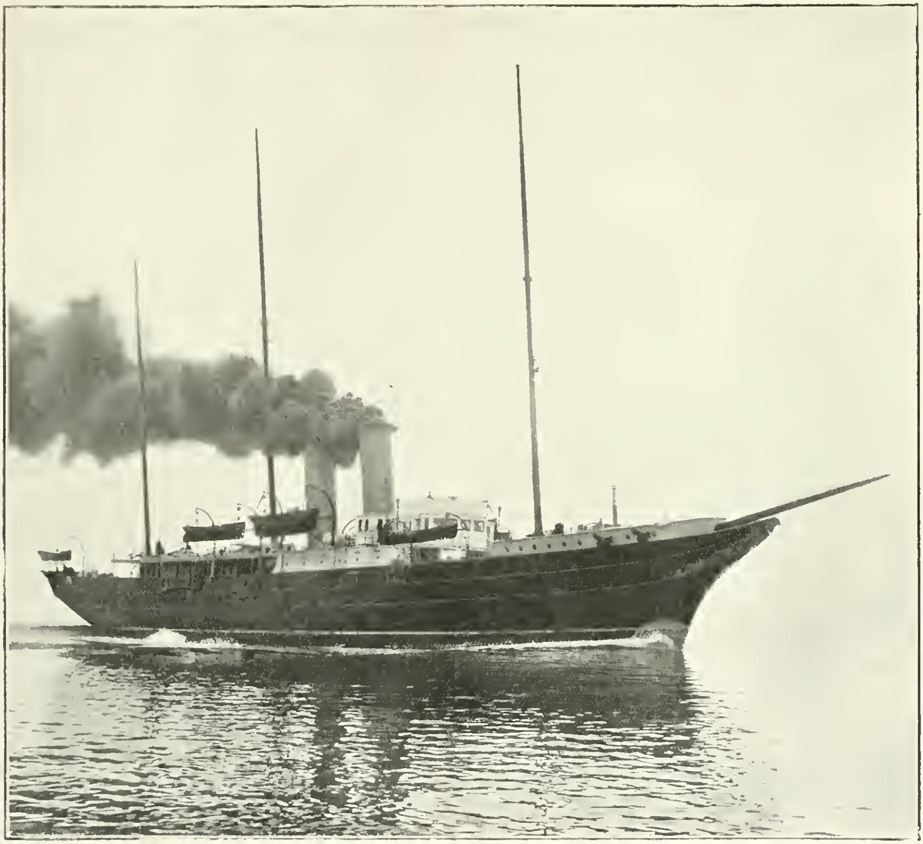
It is generally agreed here that the programme of work for Pembroke as detailed in the Navy Estimates is insufficient. Still, as a proposal to reboiler and refit torpedo boat destroyers and torpedo boats at the yard is under consideration, things may not turn out so bad as expected. The "New Ship No. 3" as she is described in the Estimates, is to be begun in July. She is another *Boadicea*, and the total expenditure allowed on her for the financial year is £189,431, the wages amounting to £36,685. By the time she is laid down the *Defence*, which is still to absorb £32,100 for labour, will be completed. The *Boadicea* herself will provide us with £51,015 for wages during the financial year. Boring operations are in progress, but it is not expected that everything will be ready until the middle of May—indeed, the 14th of that month has been given out as the date of the launch. That will be ten and a half months from the date of her being laid down. Rather different from Portsmouth and Devonport, where they can get a vessel three times the size into the water in about half the time. There is one thing Pembroke cannot boast of, and that is rapid shipbuilding. Here is the *Defence*, which was laid down on February 22nd, 1905, and launched on April 27th, 1907, and she is still in hand, while the *Shannon* laid down at Chatham a month later, is now flying the flag of the Rear-Admiral commanding the Fifth Cruiser Squadron at the Nore. With regard to the *Defence*, all the gun houses have now been delivered and at the time of writing the remaining three 7·5 inch guns and four 12-pounders are daily expected. According to the official figures, the total cost of the *Defence* will be £1,377,107, while her sister ship, the *Shannon*, built at Chatham, cost £1,423,410, and the *Minotaur*, built at Devonport, £1,438,065. Here there is a difference in favour of Pembroke of £46,300 and £60,900 respectively. The *Warrior* was also considerably cheaper than any of her sisters, the *Cochrane*, *Natal* and *Achilles*, which were built by contract. Therefore, whatever may be said against Pembroke, the charge of extravagance cannot be laid. The refit of the torpedo gunboat *Halcyon* was not completed quite at the time ordered, and she did not leave until March 3rd to resume her duties under the Admiral commanding the Coastguard and Reserves. About the middle of May the non-effective cruiser *Medusa*, which is, I believe, lying in the Firth of Forth, is to be brought round here to be ballasted and fitted up for calibration purposes at Bantry. A sister vessel, the *Medea*, has been taken to Haulbowline Yard for a £20,000 refit.

Gre-Solvent.—Messrs. Beanland, Perkin & Co., of Neville Street, Leeds, have sent us a sample of a preparation known as Gre-Solvent, for cleaning from the hands machine grease, paint, ink, etc., which they have placed on the market in new form and sizes at much reduced prices. We have given it a trial and find it well serves the purpose intended.

THE ROYAL TURBINE YACHT "ALEXANDRA."

THE new Royal turbine yacht *Alexandra*, the order for which was placed with Messrs. A. & J. Inglis, Ltd., Pointhouse, three years ago, has at last been brought to completion, and herewith we have pleasure in giving an illustration of the Royal craft while under steam on March 16th on the Firth of Clyde. The delay which has taken place in her construction and outfitting, both before and since her launch in May of last year, has been almost wholly due to alterations in the original designs, and to the fastidious surveillance on the part of the Admiralty surveyors, who—like the builders, of course—have been intensely anxious to produce a vessel in every way fit for their Majesties the King and Queen and their family. That success has been attained was made evident to all observers when the vessel was, some days prior to going down the Clyde for trial, put into dry dock at Govan for hull-cleaning. During her stay there the yacht was the centre of a great deal of interest, and many hundreds of people visited the dock in order to view the vessel before her final departure from the harbour. Her graceful lines and fine deck fittings were greatly admired. The permanent Royal crew and their officers arrived prior to the vessel going out of dock and she was taken down to the Tail of the Bank on the forenoon of March 16th.

The speed trials, which it is understood were of a very exacting character, were completed on March 19th, on which day the full-power trial was run with gratifying results. All the trials were run under Admiralty conditions, and began on the 18th with a twelve hours' trial with only two of the three boilers under steam. Under these conditions the vessel attained a speed of $17\frac{1}{2}$ knots, which is only half a knot under the full average speed stipulated in the contract. On her full power trial on the 19th she ran down the channel from the Tail-of-the-Bank, round Ailsa Craig, over the "measured mile" at Skelmorlie, and back to the Tail-of-the-Bank at a speed of 19·15 knots. This speed is more than a knot over the contract stipulation, and was attained quite easily. At a "cruising" speed of about 13 knots the vessel ran at a coal consumption of one ton per eight nautical miles—a performance which was considered extremely creditable. All through the trials the machinery worked with the utmost smoothness, and the absence of vibration was very marked, the working of the turbines being scarcely felt anywhere on board.



The new Royal Yacht "Alexandra."

While there has naturally been some reluctance to make access to the interior of the Royal vessel too easy, and while

alterations have been made in many detail directions, the following general description and particulars may be given: The *Alexandra* is 275 ft. long on the water line, 300 ft. overall, and has a beam of 40 ft. and a depth to upper deck of 23 ft. The normal draught of water is 12 ft. 6 in., the displacement corresponding to which was to be 2050 tons. While replacing the *Osborne*, which is now no longer fit for service, the new yacht is an axuiliary to, rather than a substitute for, the *Victoria and Albert*, built in 1889. Being 317 ft. shorter than the latter, and, in consequence, of much lighter draught of water, and less than half the tonnage, the new vessel will be preferred for many purposes. As will be seen from our illustration, she has a top-gallant forecastle, also a bridge deck, which is 150 ft. in length and carried over the full width of the ship where it is supported by staunchions from the main rail, thus affording a sheltered promenade. The pavilion or deck-house, which this deck covers, contains the reception-room, dining-room, and pantry, while abreast of it there are two small boudoirs, which have a clear view ahead and astern, and also over each side. The King's smoking-room is under the bridge, and also rooms for the commander of the vessel, the officers and the surgeon, as well as the ship's hospital or sick bay. On the main deck, abaft the turbine room, are the Royal apartments and rooms for His Majesty's secretary, equerries and others. The arrangement for the accommodation of officers, crew and servants generally, as well as the ventilation, the cuisine and other features of the King's floating home, are, as may be supposed, of a well-devised description.

The turbine machinery of the *Alexandra* which, as is well known, has been made by the Parsons' Steam Turbine Co., Wallsend-on-Tyne, was designed to develop 4500 horse-power, and give the vessel a speed of about 18¾ knots. Of the three turbines that on the centre line of shafting is high-pressure, the two side turbines being low-pressure, while reversing turbines are incorporated in the exhaust casing of each of the latter. Special attention has been given in the design of the main features to secure accessibility, and convenience in the overhaul of parts, both main and accessory, with the least possible disturbance of the general arrangement. Pumps for forced lubrication for the bearings, with all the latest fittings for the control of the flow of oil are fitted, while an independent oil cooler and oil and feed filters are also provided. The Parsons patent vacuum augmentor and its accessories for the securing of the high vacuum desirable are also fixed. The starting and operating valves are on a level with the turbines, thus affording the engineer-in-charge a full view of the engine-room and all its features. One valve only is employed in starting, and the two manœuvring valves—that is to say, one for the pressure ahead, and the other for the astern motion—are combined, and operated by one handle. Steam is supplied from three Yarrow water-tube boilers, the products of combustion being carried off through two funnels. The steam-steering gear on the vessel is by Messrs. John Hastie & Co. Kilblain Engine Works, Greenock.

The *Alexandra*, it was intended, would leave the Clyde for Portsmouth about the beginning of April, where the decoration and upholstering of the principal Royal apartments would be proceeded with to completion, the firm in whose hands this responsible work has been put being Messrs. Waring & Gillow, London. The *Alexandra*, it is of interest to add, is the first Royal yacht designed from the foundation and specially built for turbine machinery, the other only existing Royal turbine yacht being the *Mahroussa*, formerly a paddle steamer, which, it will be remembered the Inglis firm renovated and supplied with Parsons turbines of their own manufacture two years ago for His Highness the Khedive of Egypt.

Société des Ateliers et Chantiers de France, Dunkerque.—This company has just received an order from the Compagnie Havraise Péninsulaire, Hâvre, for a screw steel steamer with a deadweight capacity of about 6500 tons. This is the fourth vessel placed by these owners with the Dunkerque Company. An order has been placed with the same builders for a hospital ship for the Iceland fisheries. This vessel will be handsomely fitted out for this service and will have accommodation for a doctor, an infirmary, dispensary captain, officers, etc., and be supplied with a compound surface-condensing engine and cylindrical boiler.

INSTITUTE OF MARINE ENGINEERS.

The annual meeting was held at the freehold premises of the Institute of Marine Engineers on March 20th, presided over by Mr. Alex. Bayle (vice-president). After a few preliminary remarks by the Chairman, scrutineers were appointed to examine the ballot papers and declare the result of the votes of the members for the election of office bearers and Council. The hon. secretary was then called upon to read the following report:—

The presentation of the nineteenth annual report reminds us that the Institute has passed that stage of its life which betokens—in respect to age—entrance into greater maturity, and it is a matter for congratulation that at such a period the year's work, closed on January 31st, 1908, has proved full of elements which show that energy and thrift have been in combination to produce satisfactory results. We have to report the carrying out of a full programme, an increase of members, and a financial balance with something carried to the capital account as a reserve, which may be utilized later on for a building fund or otherwise, as the future may aid in determining. While the membership has been increased by the addition of new members, and by the rejoining of old members who had lapsed and whom we were pleased to welcome back, it is to be regretted that there are still many who have got out of touch by changing their addresses and omitting to give notification thereof. Several names have thus been removed from the roll meantime, but such may be reinstated in the event of communications being restored; the assistance of members is invited towards such a consummation. The removal also of thirteen members by death has to be recorded with regret, several well-known prominent names will be found in the list:—T. R. Bell (member), elected 1896; H. Bertram (member), elected 1897; Jas. S. Bond (member), elected 1892; Walter Brock (vice-president), elected member 1890; W. Callan (member), elected 1893; E. Gearing (member), elected 1893; J. Macfarlane Gray (vice-president), original member, 1889; J. D. Imray (member), elected 1902; J. B. Johnston (member), elected 1893; the Right Hon. Lord Kelvin (past president), elected 1892; J. Maclachlan (member), elected 1904; Henry M. Rait (vice-president), original member, 1889; E. J. Taylor (assoc. member), elected 1893; D. G. Watson (member), elected 1899.

The membership roll on January 31st stood at 1011, after deducting removals by death, retirement and lapsing, the additions during the year being ninety-five.

The President delivered an address at the Institute premises on Monday, October 7th, and on that occasion presented the Denny gold medal awarded for the paper "The Advantages of a Technical Society," read by the Hon. Secretary at the autumn reopening of the previous session. The interest taken in the Institute by the president has been very great and the results of the session have been very gratifying to him as well as to the Council. At the close of his address he said: "It has been a very interesting function to-night to me, more in the nature of a revelation, and I shall always take the greatest, most earnest and heartiest interest in this Institute, not only for my term of office, but as long as I live." The Engineering Exhibition, held at Olympia during part of September and October, 1907, was visited on Saturday, September 28, when two papers were read on "A New Method of Repairing Boilers," and "Ventilation, Heating and Berthing," by Messrs. H. Ruck-Keene (member) and A. E. Battle (member of Council) respectively. A prize was offered for the best essay by a graduate on a visit to the Exhibition on the proposal of Mr. A. E. Battle, who provided the amount. The prize, consisting of books and instruments, was awarded to Mr. W. Smith. A special room has been set apart, furnished and provided with magazines and papers, for the use of the junior section. Lectures have been delivered on Monday evenings on the following subjects: "Boiler construction" and "Engine construction," by Mr. J. G. Hawthorn; "Electricity" by Mr. A. E. Battle; "Self-help and character" and "Something about Lloyd's," by Mr. T. F. Aukland; "External Perception" and "The doctrine of Descartes," by the Hon. Secretary; and "Roller bearings," by Mr G. B. Woodruff. A series of lectures was to have been given by the late Mr. J. Macfarlane Gray, but illness prevented; two of the lectures have, however, been printed in the transactions and will be read with deep interest. During the session

eight papers, in addition to the two read at the Engineering Exhibition, have been read and discussed.

Visits have been paid on Saturday afternoons to the following named works: Messrs. J. Kirkaldy & Sons' Testing Works, Southwark; Vickers, Sons & Maxim's Works, Erith; the London Hospital; the Great Eastern Railway Works, Stratford; A. & G. Mumford's Works Colchester. Friday evening once a month has been devoted to social recreation; five concerts have been given and arranged by the following members of Council, kindly assisted by the ladies who provided the refreshments: Messrs. F. Cooper, D. Hulme, Jas. Adamson, Geo. Adams and J. F. Redman. These concerts have been largely attended and greatly appreciated. A social at home with dancing was held on December 31st, on the invitation of Messrs. Hawthorn and J. Lang (conveners of the Junior Section), when the limits of the accommodation were tested to the full. The premises were decorated for the occasion, and the successful nature of the gathering was conspicuous. The fuel testing has not been carried on to the same extent as in former sessions, but the convener of the Experimental Committee is always ready to make arrangements for a test when desired. Owing to an appointment being offered to Mr. H. Bertram while serving on the Council as hon. minute secretary, he resigned in order to proceed to South America. Previous to leaving, a few friends invited Mr. and Mrs. Bertram to supper, and presented to him a small souvenir in memory of our association in the work of the Institute. Unhappily, Mr. Bertram died a few weeks after he arrived in Brazil. Mr. J. G. Hawthorn was appointed hon. minute secretary instead of Mr. Bertram. The annual dinner was held in the King's Hall, Holborn Restaurant, on October 30th. Mr. J. Dixon, chairman of Lloyd's Registry of Shipping, kindly proposed in the course of his speech that a bursary for marine engineering should be founded, towards establishing which he would assist. This has been receiving the attention of the Council, and a plan is in course of preparation to carry the proposal into effect. The conversazione held in the Holborn Restaurant on Friday, January 24th, was eminently successful, both in respect to the concert and the dance. The singing and recitative were good. The dancing in the King's Hall was kept up with great fervour till 3 a.m., and simultaneously with the dancing, selections of vocal and instrumental music in the Throne-room afforded another pleasant means of recreation. The function proved very enjoyable to all who were present to witness the brilliant assembly. The Tennis Club was carried on during the summer and the court was extended to accommodate more players than formerly. The season was wound up by a social gathering on September 27th. The membership was about thirty-six. In order to bring the Institute to the notice of engineers, a circular was prepared and issued to the various steamers on entering port; but this has not been productive of much gain in adding to the membership. The attention of members is called to this circular and to the invitation cards, also to cards which may be obtained on application for the purpose of introducing friends, who are not members, to the privileges of the reading-room and the various meetings. At the Sanitary Congress held in Dublin during the month of July, 1907, the Institute was represented by Mr. Jas. Girvin (member). A report of the congress has been printed in the transactions. The property has been overhauled, cleaned and painted where necessary during the year, and a frame with the name of the Institute placed over the porch fitted with electric light, to indicate the premises more clearly to strangers. The Library has been added to and increased by several volumes, and the reading-room is well supplied with magazines, journals and papers for the benefit of visitors. The scrap-books for press cuttings or notes of occurrences and events of interest, or for reference, are commended to all members, so that contributions to these books may be forwarded to the convener. The issue of the Transactions in monthly parts regularly has been hailed as an improvement, especially by members abroad, and the letters received expressing this view have been welcome as tokens of appreciation. Our Transactions are exchanged with several kindred societies at home and abroad, so that our reading-room and library are supplied by contributions from many sources, thus adding to their value to visiting members. Conferences are being arranged to be held at St. Petersburg on "Navigation" at the end of May, and at Paris on "The refrigerating industries" in September. We have been invited to co-operate and appoint representatives to attend at these conferences; with these invitations we hope to be able to comply. Arrangements are being made for a course of summer Saturday afternoon visits to works. It is proposed to arrange two visits to the Exhibition now in course of erection at Shepherd's Bush, when lectures and papers will be delivered; the announcements in connection with these visits will be made as soon as the arrangements are completed. A Municipal Exhibition is to be held in the Agricultural Hall, Islington, in the course of a few months, and a proposal has been made to have a marine section dealing specially with heating, sanitation and ventilation; should this proposal be carried out, a paper on the subject will probably be given by a member of the Institute and the date duly intimated. In the course of the year it has been considered that the advisability and wisdom of having premises located within the city of London boundary should be discussed at the annual meeting, so that the office bearers and Council might know the desires of the members on the subject in order to guide them in any future possible negotiations. There are advantages and disadvantages in respect to the location of the premises of the Institute; the main advantage of any location is that it be convenient for our seagoing members. A new edition of the bye-laws requires to be printed, and all the alterations which have been made from time to time will be embodied in it under the respective clauses, to facilitate reference and accuracy. It is suggested that a slight alteration should be made as to the retirement of members of Council, under which five in place of eight should retire annually. The Council meetings were formerly held on Friday evenings, but as it was found more convenient for the majority to attend on the first and third Thursdays of each month the evening of meeting was altered, in view of the importance of a greater regularity of attendance for the majority. Unfortunately, as Mr. Blelloch could not attend with any regularity, and as Thursday evenings were even more inconvenient for him to attend, he resigned his seat. We are indebted to Mr. Blelloch for the assistance rendered to the Institute by his service on the Council. Mr. Geo. Shearer has been serving on the Advisory Committee as a representative from the Institute to the Board of Trade during the year. In closing this report it is urged that every member should do his utmost to advance the aims and objects of the Institute.

The Hon. Treasurer then submitted the revenue account and balance sheet, the former showing a credit of £139 at the end of the financial year, and the latter showing assets amounting to £3191. The report of the chartered accountants who audited the books was also read.

Mr. John Clark (Hon. Auditor) proposed and Mr. G. W. Newall seconded, the adoption of the reports in language which was listened to with evident pleasure.

The Chairman proposed a vote of thanks to the retiring president in words of elequent appreciation for Mr. Jas. Knott, whose year of office had been so fruitful of progress; the words quoted in the annual report were again referred to and the donation he had kindly given to the funds of the Institute. Mr. W. C. Roberts, R.N.R. (vice-president), seconded the vote, which was heartily accorded.

Several suggestions were made by Messrs. F. Cooper, R. Balfour, G. Adams, W. C. Roberts, E. Sharp, E. W. Ross, A. E. Battle, J. G. Hawthorn, J. McLaren, the Hon. Secretary and others, and after some discussion conducted on excellent lines, and enthusiam for the best interests of the Institute as a whole, a recommendation was passed to the Council to consider the best arrangement possible for suitable rooms in the city to be open during the day for the convenience of members. An interesting diagram was drawn by Mr. J. R. Ruthven to show the areas embraced by the membership. A vote of thanks to the office bearers and Council, proposed by Mr. Thom and seconded by Mr. K. C. Bales, was responded to by the Hon. Secretary, who referred to the absence of Mr. W. Lawrie by reason of an accident, which confined him to hospital, and proposed that a resolution of sympathy and best wishes for speedy recovery be passed for conveyence to Mr. Lawrie.

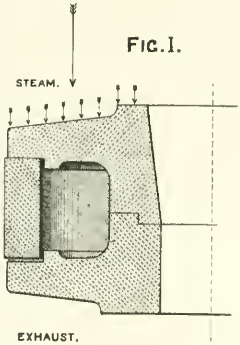
Messrs. P. Smith and F. M. Timpson, scrutineers, then reported the results of the voting papers, and announced that Jas. Denny, Esq., had been elected president. The other office bearers and members of Council were re-elected with the addition of Mr. J. T. Milton. The scrutineers were accorded a vote of thanks on the proposition of Messrs.

Farenden and J. McLaren. The Hon. Auditors, Messrs. John Clark and A. Robertson, were re-elected on the motion of Mr. E. W. Ross, seconded by Mr. J. G. Hawthorn. The proceedings closed with a vote of thanks to the chairman proposed by Mr. T. F. Aukland.

PUMP-BUCKET PACKING RINGS.

ONE of the most troublesome details connected with steam, hydraulic and other machinery in the experience of most engineers has been pump buckets and their packing rings. To escape the worries and troubles usually attending the use of spring rings it has been a common practice to fall back upon some form of solid or adjustable ring, however inefficient. Convinced that the solution of the difficulty is not merely a question of wedge-shaped or restricted rings, broad rings or narrow rings, nor of special forms of springs, or the material of which these are made, but that it lies in the fundamental principle of action, the firm of Messrs. Andrews & Cameron, Kelvin Engineering Works, Kirkintilloch, N.B., have

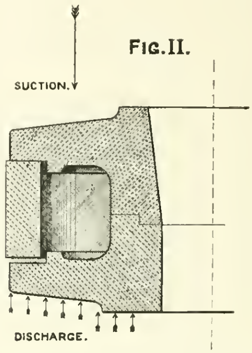
FIG. I.



for some considerable time now made, and are increasingly supplying engineers with, patent packing rings, which it is the purpose of this article to bring under notice.

The principle on which the design of this firm's packing rings is based may be gathered from Figs. I. and II. herewith Fig. I. represents a steam piston packing ring moving with the pressure in the direction of the arrow. It will be gathered that if the ends of the packing ring present a good scraped surface to the adjoining flanges of the piston, the back of the ring is exposed to the exhaust pressure when the ring is a loose fit, as exaggerated in the sketch, and the natural spring of the ring prevents the passage of steam, while the frictional resistance of the ring against the cylinder barrel makes the joint between the upper flange of the piston and the ring tighter. Looking now at Fig. II., which represents a bucket-packing ring moving against the pressure in the direction of the arrow, it is clear that the water pressure gets freely behind the ring and has no means of escape. The consequence is that the ring is forced against the pump barrel with a pressure equal to the water pressure, which no material in existence can be expected to stand satisfactorily. Probably the worst of all materials to stand such pressures are of the ebonite class, but in any case the amount of friction is

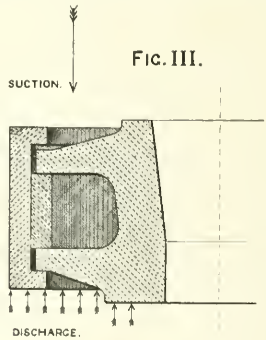
FIG. II.



out of all proportion to the service for which the rings are intended, and friction means wear and tear and waste of money everyway.

Designed to act in the same way as steam-piston rings, the bucket rings as made by Messrs. Andrews & Cameron are illustrated by Fig. III. The outer ring has a flange top and bottom, which rests on the corresponding flange of the bucket: the opposite of the ordinary ring. A spring ring between the bucket

FIG. III.



flanges fits closely into the back of the outer ring, pressing it against the working barrel sufficiently to be tight only. The effect of this novel device is that the pressure no longer gets behind the packing rings as in Fig. II., because the discharge pressure forces the flange of the ring tighter against the piston flange. If the ring fits loosely between its flanges, the loose flange is on the suction side, and the back of the ring is exposed to the suction pressure, consequently the

ring acts upon the pump barrel with its natural spring only. There is no abnormal friction or tearing up of pump barrels, because there is no undue load on the rings. Maximum mechanical and hydraulic efficiency are obtained. Rings designed on correct first principles stand up to almost any pressure, and the firm, we understand, have bronze rings working in bronze barrels at 250 lbs. per sq. in. These rings can be applied to many forms of pistons or buckets, and existing pistons or buckets can generally be adapted to suit.

Wrinkles in Practical Navigation (25/-). By S. T. S. Lecky, and revised by W. Allingham. London: Geo. Philip and Son, 1908.

The author of this work, which contains nearly 800 pages and 135 illustrations, writes in a true breezy fashion, judging by his prefaces, and it occasions no surprise that the results of his labours have been thus appreciated and live after him. The general reasons for this are fairly apparent to anyone practically acquainted with the subject, as the division of the book into heads shows. For instance, we have just what a sailor requires, books and instruments, next the earth and its general characteristics from a geographical point of view. The instruments themselves, so important a feature, then come in for description, the compass, chronometer and sextant. That aid to practical observation, the artificial horizon, with which a student commences, is then described, followed by the sea horizon, charts and details that are required, such as parallel rulers and protractors. By this time the author has reached actual observations and takes up azimuths first, but diverts to some extent by introducing logs and sounding machines, telescopes, compasses and barometers. Meteorology and tidal actions may be said to form a conclusion to the first of the two parts into which the work is divided. In the second portion, the finding of latitude and longitude, the object of all observations at sea, is described in its various forms. This then gives the general plan the author adopts, and we will attempt to go closer into his descriptions that we have thus passed over in rapid review. It will be seen he leaves little untold and with the magnitude of his task his aim has been to evolve a sort of nautical encyclopedia. Hence his success. A schoolboy could read a great deal of this. The language is simple enough, but the matter is at once seen to be that of a considerable and thoughtful mind. As an example, it is noted that the density of the earth at the Himalayas is less than that in the plains below, and that to this fact it is due that such a mass of earth does not attract the sea of the Indian Ocean as would otherwise be the case if the two were the same. In compasses, the author is at home, as he is an inventor himself. The finding of a ship's position by traverse is very fully gone into and in such a way as to be interesting to a reader. The problem of tidal action is also closely reasoned out, while the author's aim in his second part is to familiarize sailors with astronomical observation methods, and here again he commands attention. He says third magnitude stars are not worth troubling about and therefore proposes to confine himself to about 100 Nautical Almanac principal ones. We cannot stop to follow the author through all the problems he instances for finding latitude and longitude, but it is sufficient to say that he enumerates them all. As he says, he does not go too closely into such ones as lunars for the reason that these are no more. They have gone the way of primage and such things of the past. The connection between the sun's position and latitude is closely reasoned out. The author does not throughout treat the subject in the orthodox fashion, merely as a record of problems, but it is a popular dissertation and giving the basis that underlies the whole matter. It is, therefore, quite up-to-date from a practical sailor's point of view as to how to find positions at sea. Some space is taken up with compass adjustment into which we need not enter. There are also many points of a mathematical character made, such as strains of loads suspended in rigging, charts and fixing position by bearing, but it may truly be said with them all, that the author is an entire master of his subject, and it is to be readily understood the success he has attained by these pages.

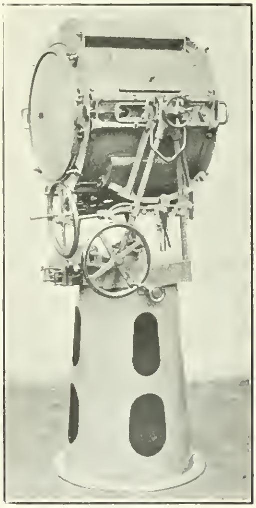
ELECTRICITY ON BOARD SHIP.

XVI.*

By Sydney F. Walker, R.N., M.I.E.E., Assoc. M.I.C.E., etc.

Search Lights.

As explained in the previous article, the office of the search-light is to direct a very powerful beam of light in a particular direction. In the case of men-of-war, the object is to show up any approaching object, such as a torpedo boat. In the case of a mercantile marine, the great liners of which all carry search-lights, the object is practically the same, to show up any approaching ship, when required, and it has also a special office in the case of ships going through the Suez Canal. As readers of *The Marine Engineer* will know, the banks of the Cana are not lighted sufficiently at night for ships to pass through it, but ships are allowed to go through if they are themselves provided with search-lights, arranged so as to illuminate the bank on each side. The special features of the lamps designed for this purpose will be explained later. The search-light is necessarily employed at different parts of the ship. On the bridge, the forecastle,

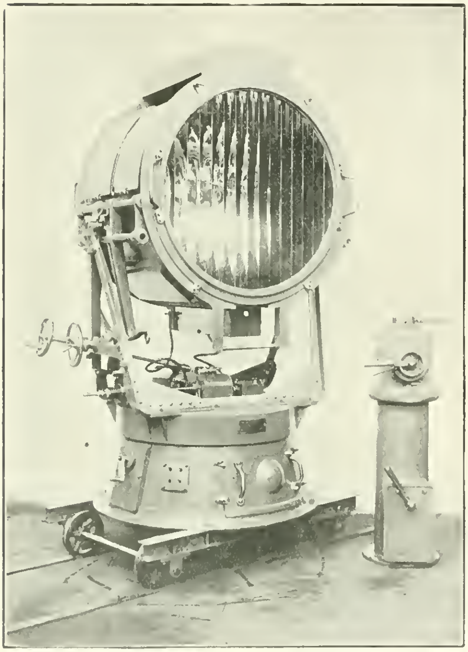


20-inch Light Weight Projector, fitted with slow training and tilting gear.

the look-out, the fighting tops, in the case of men-of-war, and in fact the lamp must be arranged to be fixed temporarily in any position from which the surrounding sea space can be conveniently swept, and, of course, must receive its current in whatever position it is fixed in. Necessarily also, the whole apparatus must be portable, and the usual arrangement is, the lamp is enclosed in what is called a projector, of which one form, made by Messrs. J. H. Holmes & Co., was shown in the last article. As will be seen from that drawing, the projector consists of a hollow cylinder, inside which the lamp is fixed. It is usual for the lamp carbons of search-lights to be held in a horizontal position, two lamp holders rising from the base of the projector for the purpose. The projector also carries a reflector behind the lamp, and sometimes a plain glass, sometimes a system of diverging lenses in front of the lamp. It will be remembered that with any source of light, light rays pass out in all directions from it, and in the case of the search light, only those passing out in front could

* For Articles I. to XV., see previous issues.

be utilized, if it were not for the reflector behind. The reflector behind, which is carefully designed, is arranged to throw forward the back rays from the arc, these being added to those which pass out in front of the arc, and increasing the total quantity of light furnished by the beam. With any given projector also the width of the beam of light will be the same as the diameter of the projector, unless some method is adopted of widening it, and this object is accomplished by the system of lenses mentioned above. In the projector arranged to furnish a diverging beam, the front of the projector case is occupied by a number of vertical lenticular lenses. Practically these are pieces of very pure glass, ground to a certain form, such that the rays of light impinging on them from behind will be directed outwards from the centre



36-inch Electrically Controlled Projector, fitting of traveller and showing controller.

of the projector, and so a diverging beam can be obtained of any width that may be designed. It need hardly be pointed out what a great advantage this is, when sweeping the horizon, on the look-out for approaching ships. In case of distress, for instance, or in case of war, the diverging beam covering a larger arc of the horizon than the simple beam emitted by the projector, enables the search of be carried on very much more efficiently. For the Suez Canal a dark space is left in the centre, so that the banks are lighted but not the Canal itself.

Other requirements of the search light are, that it shall be capable of being moved in a horizontal plane, practically all round the horizon. That is to say, the projector, with its lamp and accessories, must be capable of making a complete revolution upon a vertical axis. It will be evident also that the projector, if it is to be of any real service, must be capable of being depressed and elevated within certain angles. In the case of men-of war, for instance, the approaching torpedo boat may not be discovered until it is very close and unless the beam can be thrown right down on to the approaching vessel, the apparatus is useless. The above requirements are furnished by mounting the projector itself, very much as a gun is mounted. It is fitted with trunnions, cylindrical projections on each side of a diameter at the middle of its length, the projections being sufficiently strong to bear the weight of the projector-lamp and accessories. The projector in fact, is borne by them, and they, the trunnions, rest in trunnion bearings, carried by a supporting platform. Screws worked by hand-wheels, as shown in the drawing in the last article, provide for raising or lowering the rear part of the projector, depressing or raising the front, and this, it will be seen, provides for one set of the movements required. The other set of movements is provided by means of a turntable. The platform carrying the supports of the trunnions is arranged as a turntable. It is pivoted on a centre, round which it can move, just as a capstan does, and its movement around the centre is also regulated by a screw, worked by a hand-wheel, as shown in the drawing. The turntable is mounted on a support, which takes various forms. In the apparatus shown in last month's article, it will be seen, the support is a short vertical pillar. In other cases the support is a longer vertical pillar, and again, in still other forms, the turntable itself has its lower portion widened out to form the support. The kind of support provided will vary necessarily with the work the search-light is intended to perform.

As indicated in the last article, search-lights are arranged to work their carbons automatically just as other arc lamps do, or to be worked by hand. It is the common practice, with modern plant, to provide the projector with both automatic and hand regulation. With automatic regulation the current is led to the lamp, as will be explained later, it is switched on, the lamp lights itself, just as other arc lamps do, by breaking the connection between the carbons, and it feeds itself, as other arc lamps do, by moving the carbons nearer together as they burn away. It will be understood that with all search-lights the arc must be arranged to remain always in the focus of the mirror at the back. The automatic feeding mechanism should provide for this. When it is required to control the lamp by hand, the automatic gear is cut out, and the man who is attending the apparatus controls both the movements of the projector by the hand-wheels mentioned, and also the movements of the carbons by other hand wheels.

The projector itself is also arranged to be controlled from a distance automatically by means of electric motors. The base carrying the turntable, or the turntable itself, is arranged to accommodate two small electric motors, one controlling the motion of the projector in its trunnions, depressing or elevating it, and the other controlling the motion of the turntable, turning it right or left, as may be desired. Where this arrangement rules, it is usual to have a controlling pillar, fixed in any convenient position, say on the deck or on the bridge, having three switch handles, one for the current to the lamp, one for the current to the trunnion motor, and the other for the current to the turntable motor. It is usual to arrange these switches so that the motion of the hand on the handle of the switch corresponds to the motion it is desired to give to the projector. Thus the switch handle for the turntable is placed on top of the pillar, and moves right round the pillar, in a circle. The switch for the trunnion motor is on the side of the pillar, a little below the top, and is arranged to be moved up and down, as the front of the projector is to move up and down.

As will be explained when describing how the current is delivered to search-lights, it is usually necessary to have a resistance in circuit with the lamp, and this may conveniently be enclosed within the controlling pillar, where one is used. The amount of light also given by search-lights varies with the size of the projector, the current taken by the lamp and the size of the carbons. Projectors range from 16 in. in diameter up to 36 in., the current taken by the lamps ranging from 30 ampères up to 150 ampères, the carbons varying in size in proportion. The pressure taken by any search-light rarely exceeds 60 volts, and is more commonly from 45 to 50 volts, this being arranged, as will be explained, by means of the resistance. For the Suez Canal the projector is usually worked from a platform hung over the bows, so that the light only shows on the banks as explained above. We give two views of the latest type projectors constructed by Messrs. Crompton & Co., Ltd., of London.

ELECTRIC WARPING WINCHES.

THE extension of the use of the electric current for marine work proceeds apace, and we have pleasure in describing and illustrating an electric warping machine designed and manufactured by Messrs. J. P. Hall & Co., of Blackriding Ironworks, Oldham. Fig. 1 of the adjoining illustrations represents the machine as it appears ready for work, and Fig. 2 shows the machine with several of the enclosing covers removed, exposing the interior.

As seen from the illustrations, the bed of the winch is a strong cast-iron frame of box section, on the top of which the gear-box is fixed, being held in position by a mid-feather and steel screws. At the other end of the bed the motor is carried, while the space under the gear-box is utilized for the resistance-box.

The type of motor used is the well-known reversing crane type of this firm, who, we understand, have

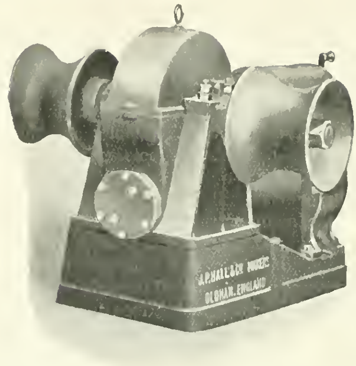


FIG. 1

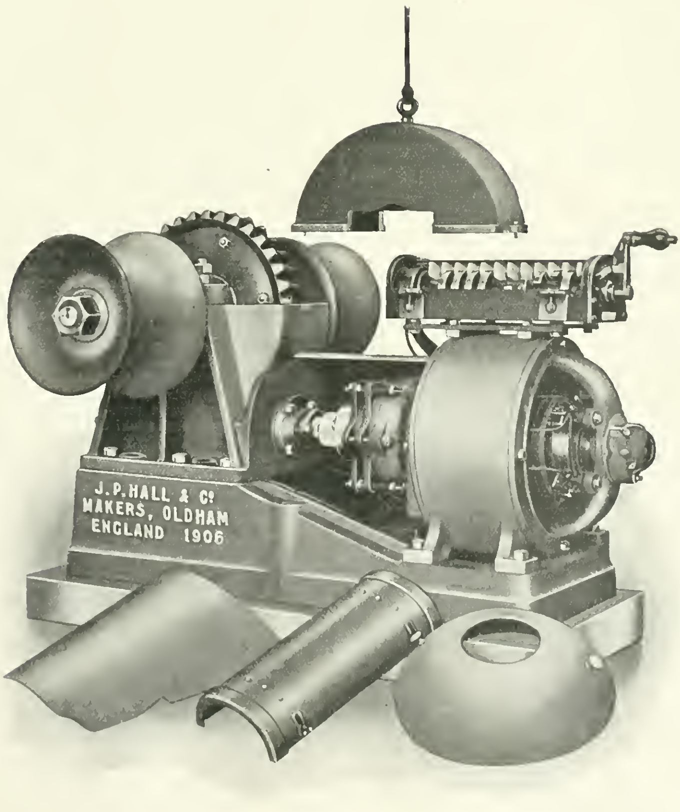


FIG. 2

supplied machines during the past few years aggregating over 30,000 brake power. The motor is series wound and entirely enclosed, and is rated for a continuous full-load run of half an hour with a temperature rise of 75° F. The controller is of the tramway type, arranged to reverse the direction of rotation of the motor, and between the motor and the gear is fitted a magnetic brake for holding the motor when the current is off.

The gear-box itself forms an oil reservoir, and carries the main bearings and also the bearings for the worm spindle. The worm-shaft bearing farthest from the motor is provided with thrust collars, while the other bearing has a gland through which the shaft passes, as the worm-shaft bearings are below the level of the oil and are so arranged as to secure automatic circulation. The shaft carrying the warping drums is of steel, and the worm wheel is formed with a cast-iron boss and a bronze rim fixed thereto into which the teeth are cut.

The winches are made in two sizes, the smaller being designed to give a pull of 30 cwt. and the larger a pull of 60 cwt. on the rope, the speed in each case being 50 feet per minute. They are capable, however, of giving a higher speed at lighter loads. The warping drums are of cast-iron, and are $10\frac{1}{2}$ inches in diameter in the smaller size and 12 inches in the larger size at their smallest diameters. The nett weight of the machines is 25 cwt. and $35\frac{1}{2}$ cwt. respectively.

ELECTRICAL NOTES.

(From our Own Correspondent.)

Electric Power in Dock Works.

An important paper has been read lately before the Institution of Electrical Engineers on the above subject. We have frequently in this column called attention to the matter, by way of showing improvements that have been effected in this direction. It was mentioned that an important factor is the being able to utilise the town's supply. The high gantry crane is used for loading general cargo and capstan for short distance traction, while for coaling vessels, cranes and hoists are usually adopted. For coal loading, special apparatus is sometimes in use. This consists of belt spouts, which are raised or lowered on pivots, and the coal descending in these falls over into the hatch, as required, the speed of the belt conveyor being about 120 feet a minute. Another improvement is for the coal to drop into buckets on a conveyor instead of being shot into the hold. A jib crane is employed to lift the conveyor to required level and the effect of the whole apparatus is that 500 tons can be shipped by each conveyor in one hour and this without breaking, which results from the shooting into the holds, whereas by the bucket improvement this is avoided.

Commutators.

The care of this important part of a machine is well-known. The brushes must not be allowed to wear unduly on the commutator. The latter, also, should be cleaned regularly and, if it does get rough at all, sand paper becomes useful. To avoid turning, when this is not possible, a stone block of the required shape will do the rubbing down better than sand paper. Whichever of these methods is used, however, some dust has to be dislodged after the operation, which requires special means to deal with, such as a jet of compressed air, if this can be obtained. When the commutator has high and low bars, however, it is advisable to remove these without taking the commutator from the frame. In these the grinding wheel usually runs across the surface of the commutator, the driving being by means of a specially prepared friction wheel, running on the commutators or by belt round the commutators or shaft. The trueing up of the commutator is very desirable to prevent sparking.

Electric Lamps.

There seems to be no end to the variety of types of these. One is the Jandus Regenerative Flame Lamp, in which the length is 36 in. over all and the positive carbon is at the bottom, the negative one being vertically above this. The striking is done by mechanism without any clockwork. The carbons are surrounded by an inner glass cylinder and the chemicals from the bottom carbon rise through the arc, intensifying the light, and the effect is said to be that the inner cylinder becomes filled with a light cloud of chemical fumes, resulting in an intense glow and softly diffused light, the upward draught keeping the walls free from fumes. It will be seen that one pair of carbons only is used and these are very short. The burning life of the lamp is given as 70 hours. The lamp is British make.

Metallic Filament Lamps.

We are all familiar with the carbon filament, but the new metal one is not so well known, being indeed only just placed on the market. The question is, what is the material from which these filaments are made and its properties. It is a metal tungsten that is employed and small parts are put together in the form of a paste, the operation being secret, and then passed through orifices by pressure. Tantalum is somewhat different, as it can be drawn into wire-like iron. Coming to the advantages of this class of lamp, the efficiency of the Osram lamp is about 70 per cent. higher than the carbon filament one. Tantalum lamps can only be manufactured which have a consumption of 50 per cent. more current than Osram or tungsten. These lamps, or most of them, however only burn in a vertical position, as the filament gets soft at a high temperature.

Wireless Signalling.

Some experiments described in a German technical paper indicate that it is possible by electric waves to affect a photographic plate so that the plate becomes a receiver instead of the ordinary coherer. The action of this coherer consists in the passage of minute sparks between the metallic particles, followed by partial melting together of the particles and a lowered resistance, and the idea was conceived that this passage of sparks might be recorded photographically. A plate was prepared in a certain way and subjected to the action of electric waves. On developing the plate a clear sign was shown on which there was nothing seen without the waves, the record being stronger the longer the action continued. The experiments were repeated at a distance of 70 miles away from the room in which the spark gap was placed, the sparks being obtained from a small influence machine with 7 in. plates and giving a length of spark of 1·2 in., an antennæ of 20 m. high being employed. The results are said to have been quite satisfactory and showing that the limits were not nearly attained. It seems likely, therefore, that on this plan, dot and dash messages will be possible later and that valuable results have been reached.

Saint Jean.—On March 1st, the Société des Ateliers and Chantiers de France launched from their yard at Dunkerque a steel screw steamer constructed for the Nouvelle Société Navale de l'Ouest, Le Hâvre. She is of the awning deck type with large holds, is classed in the Bureau Veritas and has the following dimensions:—Length between perpendiculars, 285 ft.; breadth, 38 ft. 9 in.; depth moulded, 23 ft. 6 in. Her equipment includes six large steam winches, four steam cranes, steam-steering gear, steam windlass, etc. The engines, which were also constructed by the Ateliers et Chantiers de France, have cylinders 19 in. by $30\frac{1}{2}$ in. by 51 in., with 36 in. stroke. Steam is supplied by two cylindrical boilers working under Howden's system of forced draught. The vessel was launched with her engines and boilers on board ready for sea. As she left the ways she was christened *Saint Jean* by Madame Cremer.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

Labour Disputes and Unrest.—While the arena of actual dispute in connection with labour disaffection in shipyards and engineering shops for some time has been confined to the North-east Coast of England, unrest and premonition of coming trouble have also influenced the position of affairs on Clydeside. At the moment of writing, and after all the conferring and balloting of the past two months the position on the North-east Coast seems to be "as you were"—and worse! Engineering employers in that district have just issued a statement to the effect that in consequence of the refusal of the engineers to accept the modified settlement terms proposed by the President of the Board of Trade (Mr. Lloyd-George), they had reverted to the position existing at the beginning of the dispute, when the demand was for a reduction of 1s. weekly on time wages and 2½ per cent. on piece rates. The non-union workmen, "an organized society having over 1000 men on its books," has just stepped in and threatened to approach the masters, as has been done they say, "by twenty-two other trades involved in the dispute who have come to terms with them." As an organized society they contend they are justified in acting in harmony with the great body of trade unionists who have accepted the terms and who are now working. Whether this and the employers' reversion to their original stipulation will bring about a settlement is doubtful, but there can be no doubt that the continued resistance to even a modified reduction from the original proposal in the price of labour is seriously hindering the return of the shipbuilding trade to any degree of its former activity.

New Orders.—The decisive placing, and in several cases the actual laying down, of important new vessels of a good class for steamship companies, whose slowness to positively fix the contracts has given rise for many weeks past to varied and conflicting reports, puts at least a cheerier aspect upon the existing condition of things in a number of the largest Clyde yards, and encourages the hope that the great depression which has prevailed now for many months may soon be much mitigated. The contracts alluded to were for better-class vessels than their immediate predecessors in the same fleets and the actual placing of orders was, no doubt, deferred in some measure in anticipation of reductions in the price of steel and iron. This hesitancy has been justified by events, and it seems probable that with prices at their present reduced rate—and possibly with further reductions—that orders may more plentifully be forthcoming not only for vessels of the "liner" class, but for intermediate and even cargo-carrying purposes. The building of three of the five Orient liners, ordered after much delay, has now actually been begun in three Clyde yards. The London and Glasgow Company, the Fairfield Company and Messrs. John Brown & Co., Clydebank, are each laying the keel of one of these liners. The first-named yard, however, has only the Orient liner, while the Fairfield Co. has in addition only one other steamer, a Canadian Pacific vessel of the smaller class. The Clydebank firm, besides the Orient liner, has received the order for a second turbine vessel for the Great Eastern Railway Co., sister to the *Copenhagen*, completed by them about two months ago. Of the two 18-knot turbine mail steamers which the Austrian-Lloyd require for their service between Trieste and Alexandria, one has now been placed with Messrs. William Denny and Bros., Dumbarton, the firm which built many of this Company's earlier steamers. The contract for the second vessel has been placed with Messrs. Swan, Hunter & Wigham Richardson, Wallsend-on-Tyne. The turbine machinery for the first vessel will be made by Messrs. Denny & Co., Dumbarton, whose experience with turbine machinery, as is well known, is extensive. The turbines for the Tyne-built vessel will be made by the Wallsend Slipway and Engineering Co., whose experience also with turbines is great, evidence of which is found in the Cunarder *Mauretania*. Two vessels for the Holland South American service have just been ordered, one from Messrs. Alexander Stephen & Sons, Linthouse, and the other from the Flushing Shipbuilding Co. The vessels, which are for passenger and cargo carrying, are 430 ft. in length. The Pacific Steam Navigation Co. are contemplating further additions to their fleet of four steamers, and tenders for these are being taken from several Clyde firms, one of whom, Messrs. William Beardmore & Co., Dalmuir, are at present completing the last of a trio of somewhat similar steamers for the same company. Messrs. Scott's Shipbuilding and Engineering Co. have contracted to build a steamer of 300 ft. in length for the Holt Line. Messrs. A. Rodger & Co., Port Glasgow, have secured a contract to build for London owners a steamer of about 225 ft. in length and of 1000 tons gross. Messrs. Alley and MacLellan, Ltd., Polmadie, Glasgow, have recently received orders for six steel barges for South America and a steam launch for Siam. These boats are to be built at the yard at Polmadie, shipped in pieces, and re-erected at destination abroad.

Work at Pointhouse Shipyard.—Although with the departure on March 16th to run her trials of the King's yacht *Alexandra* (a description of which and an illustration taken from a photo of the vessel while under steam appear elsewhere in this issue) from the Pointhouse shipyard, over which Dr. John Inglis so ably presides, work there is shorn a little of its notability, there is still another palatial steam yacht undergoing completion at the builders' wharf, while, as regards work on the stocks, there is also more than the average Clyde yard can boast of. Mr. C. K. G. Billing's fine steam yacht *Nadis* is drawing near the finishing touches and will be tried for speed before the month is out, forming a much more expeditious job than the production of His Majesty's yacht, which was ordered over three years ago. Amongst several other craft on the stocks there is the train-ferry steamer for South America, similar to the *Lucia Carbo* built for the same service early last year, and a new steamer for the Irish mail service of Messrs. G. & J. Burns.

New Naval Work.—The ocean-going destroyer which Messrs Wm. Denny & Bros., Dumbarton, are to build for the British Government is to be named *Maori*, and along with the other five vessels of the class recently placed is to be propelled by Parsons turbines, using steam generated by oil fuel and to attain a speed on trial of 33 knots. The Dumbarton firm still continue their speed and other tests with the first of the quartette of coastal destroyers they are at present constructing for the Government. Speed and oil consumption trials have been proceeding for a month or more past, and with modifications on the size and form of the propellers and other features of the propulsive agents. Much valuable data, it is understood, is being accumulated as regards propeller efficiency in relation to turbines and as to the efficient consumption of oil fuel. Messrs. Yarrow & Co., of Scotstoun, have received from the Portuguese Government a contract for the construction of one of their very shallow-draught gunboats for Macoa. This vessel will be 120 ft. in length by 20 ft. beam, and will draw, loaded with 25 tons, only 25 in. The guaranteed speed is 12½ statute miles an hour. The vessel will be armed with suitable artillery, and the various stations where the officers and men will stand will be bullet-proof. The propelling system will be by means of a Yarrow water-tube boiler and engines driving two screws working in tunnels fitted with Yarrow's patent hinged flap aft. The vessel will be completely put together at Messrs. Yarrow's new works at Scotstoun, on the Clyde. She will be shipped in pieces, re-erected, riveted together and launched at her destination in China.

New Dock Transporters.—The Clyde Trustees, on the recommendation of the Workshops and Traffic Committee of the Trust, have agreed to accept the offer of Messrs. Babcock & Wilcox, Ltd., to supply for the new Rothesay Dock at Clydebank two transporters of a type which representatives had seen working at Emden, Germany, in preference to an alternative offer to supply at the same cost—£8430—transporters of a patent design which had been seen at work at Dagenham-on-the-Thames. For a time the Committee in charge favoured the adoption of the latter type of transporter, but it was eventually decided that the Dagenham type did not fulfil for the Trust authorities the expectations which had been entertained regarding it.

New Coal Hoist at Bo'ness Dock.—A new coal hoist recently completed at Bo'ness Dock has passed through

its official tests successfully, and has been taken over by the North British Railway Co. from the contractors, Messrs. Tannett, Walker & Co., Ltd., Leeds. The hoist takes the place of one of the old hoists, and in order to be ready for the spring trade, has been manufactured and erected within six months. It is of the most modern type and has a total lift above the quay wall of 38 ft. It is designed to lift a maximum load of 35 tons, with provision for dealing with lighter trucks. The tipping table will give an angle of sixty degrees, at which ore and other bad tipping materials can be easily dealt with. The shoot is controlled by hydraulic motors, and these are under the control of the driver.

Greenock Watt Memorial.—There will shortly be ceremoniously dedicated as a Navigation and Engineering School at Greenock the James Watt memorial building, which has just been erected on the site of the great inventor's birthplace, from a fund subscribed to by sympathisers all over the world, headed by a donation of £10,000 by Mr. Carnegie. It will be entrusted to the care of the School Board of Greenock, and an adequate sum will also be placed with the Board to be appointed for the purpose of future maintenance of the building in all time coming.

Engineering Laboratory for Dundee College.—The latest addition to Dundee College will be a laboratory for the study and practice of electrical engineering. The building for the new department is a gift by the sisters of the late Mr. T. L. Peters, who was formerly a Lord Dean of Guild of Dundee, and in a letter submitted to the College Council they intimated they would give £4000 for the purpose. Attached to the offer is a condition that the new laboratory will be maintained in a satisfactory state of efficiency, and that Mr. Peters' name will be associated with it. The gift was unanimously accepted.

Sale of Aberdeen Shipyard.—The shipbuilding yard at Footdee, Aberdeen, belonging to Messrs. John Duthie, Sons and Co., Ltd., was put up for sale by public auction on March 9th at the reduced upset price of £3500. After a spirited competition between Messrs. Alexander & Richardson, engineers, Kirkcaldy, and Messrs. Hall, Russell & Co., Ltd., shipbuilders, Aberdeen, the yard was sold to the latter firm at £4440. The yard adjoins the extensive shipbuilding yard of the purchasers, and entry to it was arranged for the 21st March.

Smoke Abatement in Boiler Furnaces. — The patent combustion apparatus devised, and now being extensively applied to the boilers in engineering and other public works, by Messrs. S. Pearson, Sons & Co., Glasgow, has recently been fitted to four large marine boilers in the shipyard of Messrs. William Simons & Co., Renfrew, with the result that over a stated period of test in three of the boilers under full load the evaporation of water per lb. of coal was increased by 23 per cent., while practically no smoke passed from the chimneys. Similar results have been obtained with four water tube boilers at the works of Messrs. Fleming and Ferguson, shipbuilders, Paisley.

Admiralty Purchase of Steamers.—The Admiralty, it is reported, has purchased the Clyde river steamer *Strathmore* belonging to Captain John Williamson, and is negotiating for the purchase of the Forth pleasure steamer *Roslyn Castle*, owned by the Galloway Saloon Packet Co., Leith. The latter is a twin-screw steamer of 185 ft. in length, having two sets of triple-expansion engines, and was built by Messrs. Hawthorns & Co. Leith about four years ago. Both vessels are likely soon to proceed to Sheerness.

THE TYNE.

(*From our Own Correspondent.*)

The Industrial Situation.—The intervention of the President of the Board of Trade has not resulted in the settlement of either the shipbuilding or the engineering disputes on the North-east Coast. The main reason for the failure is that both sections appear to be beyond the reach of argument, having nothing but what they mistakenly consider their own interests in view. Distress from unemployment is everywhere present throughout the district, yet these men deliberately and without excuse intensify the suffering by the attitude they have taken up. The sections of shipbuilding employés who came out on strike several weeks ago showed the intolerant spirit which animated them by refusing to acquiesce in the settlement which had been accepted by larger and more important sections, and the engineering employés have shown themselves capable of even greater intolerance by voting on a third ballot against a proposal for settlement which practically gave them the whole ground to themselves. It is to be regretted that the employers went so far in the direction of concession, and they probably would not have done so had it not been for Government intervention. They will by now have seen, however, that a policy of conciliation must have its limits, and that it is futile to abandon all their prerogatives at the suggestion of even a Government official. The original proposal of the engineering employers was for a reduction of 5 per cent. on piece prices and 2s. per week on time wages. This was subsequently modified to a claim for 2½ per cent. on piece wages and 1s. per week on time. A further modification then was made, which allowed the existing rates of wages to stand till Easter, the question of reduction or no reduction to be then submitted to a referee. The latter was the proposal rejected on the second ballot, the pretext for rejection being that the employers might have some voice in the selection of the referee. The employers then appear to have waived all right to participate in the business of selection, and declared their willingness to leave that matter to the two gentlemen who, in this connection represented the engineering employés and the Government department mentioned. This, then, which was a practical abandonment of the whole position, so far as the employers were concerned, formed the subject of the third ballot, and it has, as already stated, been rejected. The men apparently have the notion that they can dictate their own terms, and it would not be surprising if it should ultimately leak out that some of them imagine they might supplant the masters altogether and take over the management of the works themselves. The reign of Socialism has not yet commenced, however, and we may take it that these makers of contention who apparently care for no one but themselves will be taught a bitter lesson before all is done. A deadlock now exists, and there appears to be but one means of escape from it, namely, the making of the points at issue a national question, and the giving the trade societies concerned a bigger battle than they bargained for. The shipbuilding employers will not now be in any hurry to bring about a settlement with the sections of men on strike, seeing that it will be of little use to proceed with the building of ships whilst the stoppage in the engineering works continues.

Work in the Shipyards.—At the Elswick and Low Walker yards of Messrs. Armstrong, Whitworth & Co. the building berths are almost fully occupied, a state of affairs which is in marked contrast to that existing in the majority of the other establishments on the river. Messrs. Swan, Hunter and Wigham Richardson, Ltd., are reported to have booked an order for a large turbine-engined steamer to be employed in the Trieste-Alexandria service of the Austrian Lloyd's. The firm are believed to have secured other orders lately, but are far from being booked up to their full capacity. Messrs. Stephenson have some berths still empty, but their large graving dock continues to be pretty constantly engaged for the accommodation of vessels requiring repairs. The Palmer Company's yard still has empty berths; but it is stated that there is an appearance of greater activity in the designing departments, and this is a hopeful sign, indicating as it does the probability of more work being secured. Repairing works at Jarrow and at other centres on the river are still hampered in their operations through the continuance of the shipwrights' strike, and it is understood that many extensive contracts have been diverted to West Coast and Continental ports. There is a large amount of work in hand at the Northumberland Shipbuilding Company's yard, and the Tyne Shipbuilding Company have a couple of vessels on the stocks. At other yards lower down the river a good many empty berths are, however, to be seen. The number of "laid up" vessels in the Tyne now greatly exceeds what it was a month ago, and it is expected that it will be still further augmented within the next week or two.

The Engineering Shops.—The Wallsend Slipway and Engineering Co., Ltd., are understood to have secured the contract to supply the turbine machinery for a large vessel about to be laid down at a local yard. At this establishment, as well as at the other large works on the river, the progress of work is impeded by the strike of engineering operatives; but business is not wholly at a standstill, as the foremen of the various departments and also the apprentices are still

available, and a fair amount of work is being got through by the utilization of these united services. The electrical engineering works are luckily untouched by the strike, and in most cases these establishments are kept fully going. Messrs. Scott & Mountain, of the Close Works, Gateshead, continue to be kept busy in the equipment of collieries with pumping and ventilating apparatus. Steel works and foundries are now somewhat seriously affected by the continued unrest in the shipbuilding and engineering industries, and it is understood that even in cases where contracts were booked many weeks ago, the absence of specifications is making it impossible to proceed with the work. In auxiliary engineering works slackness has increased, and it is now felt that no improvement can be immediately looked for.

THE WEAR.

(From our Own Correspondent.)

Signs of Improvement.—The circumstance that the Sunderland shipwrights and joiners are not included in the striking sections, has resulted in some benefit to the port, and, in spite of many depressing surroundings, indications of improvement are not wholly wanting. Messrs. J. L. Thompson & Sons have commenced the construction of a vessel which is said to be the largest they have yet built. It is for a company of local owners for whom the North Sands firm have built many successful vessels in the past, and it is probable that the engines will be supplied by a local engineering firm. Messrs. John Blumer & Co. have booked orders, and a couple of berths are now being prepared for the reception of keels. Messrs. S. P. Austin & Sons have a new vessel in progress, and have several vessels under repair, one of these being on the pontoon dock, and one (a turret steamer) in the graving dock passing Lloyds' Special Survey No. 3. They have also just finished the work of new decks and overhaul to a large German steamer, and the Sunderland steamer *Melbourne* is receiving new boilers at their yard. Messrs. Robert Thompson & Sons have launched a vessel recently, and have, it is said, other work to proceed with. In the firm's graving dock (Bridge Dockyard) there is just now a large vessel belonging to Newcastle owners receiving repairs. The firm have also other repair work in hand. Messrs. Osborne & Graham, of the North Hylton yard, who have hitherto been very busy, have now a berth vacant, and other firms in the vicinity have very little work in hand. Messrs. Doxford, however, have had a successful year, their realized profit being largely in excess of that accruing from the work of the preceding year. At the annual meeting of the company the chairman (Sir Theodore Doxford), in his address to the shareholders referred to the growth of foreign competition in shipbuilding, a subject which was also referred to in these pages last month.

Engineering.—At the Palmers' Hill Works (Messrs. John Dickinson & Sons) there are, we hear, some indications of an improvement in business, and we note that a steamer of large size is now at the quay for repairs. A Dutch vessel, which has been built at Rotterdam, is now in the Wear, awaiting engines which, it is understood, are to be supplied by the North-Eastern Marine Engineering Co., South Dock. Messrs. Lindsay, Carverhill & Co., of the Wear Engine Works, have just fitted two of their well known marine oil motors in boats that are intended for surveying service for the Russian Government. The non-union engineers who came out on strike with the society men, have now decided to return to work, and it is expected that a proportion of the society men will quickly follow their example.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

Imports and Exports.—During the past six years the total imports into the United Kingdom have increased in value from £528,400,000 in 1902 to £645,900,000 in 1907. Exports in 1902 stood at £283,400,000, in 1904 at £300,700,000 ; in 1905, these figures were exceeded by £29,100,000 ; and in 1907 by £50,000,000. Last year foreign countries took £288,800,000 worth of merchandise from us, or £114,500,000 more than six years ago.

Our exports of textile machinery, chiefly from Lancashire, are still on the growing side. Spindles and looms evidently find favour with the foreigner. The total value during February was £687,003, compared with £521,231 in February, 1906, and £531,425 in February last year. The best customers were British India, France, Germany, Japan, America and "other countries in Europe," besides the Netherlands and the countries mentioned, which figured for the large sum of £159,409. During 1907, Russia's imports were an increase over the two preceding years, and have gone up still more so far this year.

Copper and Brass.—An important meeting of traders interested in copper and brass was held in Manchester on the 10th March and the matter of forming an Institute discussed and considered desirable, but no definite result was arrived at beyond a resolution to hold another meeting in London.

Miloscope and Tyre Carrier.—Messrs. W. H. Bailey & Co., engineers of Salford, have just patented a motor "miloscope" and a tyre carrier. The former is a speed indicator fashioned on the principle of the concave form assumed by the surface of liquid in a rapidly rotating vessel, for which three tubes are used. According as the vessel revolves, driven by friction from the front wheel of the car through a flexible shaft, the level of the liquid in the centre tube rises or falls, carrying with it a float which points to the speed figure on an attached scale. It is only when natural law is suspended that the instrument can get out of order. The "carrier" consists of a metal ring hinged to a pillar. It is fixed to the footboard of a car, and can be opened or shut like an ordinary door or gate.

Marine Oil Engines.—Marine oil engines appear to be making steady progress, owing probably to their lightness and compactness. A departure in the oil engine, however, has just been made known in this district by an engineering firm at Patricroft. Messrs. Gardner & Sons have built a 250 h.p. oil engine for auxiliary power on a pleasure yacht, built by Messrs. J. Reed & Co., of Glasgow. The vessel is fitted with sails, but the engine will be powerful enough to render the boat independent of these should necessity arise. It is vertical, has six cylinders and develops power at 450 r.p.m. The owner, Mr. Thornton, we understand, intends making a voyage round the world in his yacht. Orders for similar oil engines have been placed for other boats in Scotland.

Salt and the Mersey Dock Board.—Owing, it is alleged, to the heavy tolls imposed by the Mersey Dock Board and the river Weaver trustees, there has been a steady decline in both export and coastwise tonnages since 1906. Smaller business is reported from the United States, British North America, and Africa. It may be assumed that no country in the world needs salt more than Africa, or would be more willing to take it, but freights and the tax on salt will have to be lowered before much progress can be reported. In Australasia, the salt tax has been increased from 12/6 to 20/- per ton.

Timber Trade.—There has been very little, if any, improvement in the timber trade during the month. There was a marked falling off in the trade in February compared with what was done in February, 1907. Stocks on the whole are ample and values fairly steady.

Canal Barge Propulsion.—Mr. E. Wilson Thom, of Southport, has promulgated a system of canal barge propulsion. He recommends the utilization of internal combustion engines, fed with coal gas carried in cylinders, under compression, in the barge. These gas engines, he contends, would only weigh half as much as steam engines of corresponding power, while they would occupy much less space—in this way increasing by 30 per cent. the carrying capacity of a barge measuring 60 feet by 14 ft. He says the initial cost would be 25 per cent less, and with compressed gas at 3s. per 1000 feet at normal pressure, the saving per annum in working two barges together would equal the cost of fitting one boat to tow the other. Speaking from actual experience, he estimates the cost of carrying a ton of coal one mile, with no return cargo, 37d. per ton ; with compressed gas, 24d., thus giving a preference in favour of gas of 13d. per ton.

Isle of Man Steam Packet Co.—The result of the poll of the shareholders in the Isle of Man Steam Packet Co. was a majority in favour of no Sunday boats, but with this proviso, that the direction of affairs be left in the hands of the directors. This is one way of evading responsibility. The directors are to serve the best interests of the shareholders. How can they do that without running Sunday boats ? Sunday boats mean

more money, and that is what shareholders in any concern hope to get.

Engineers Association Majority.—At the coming-of-age dinner of the Manchester Association of Students in affiliation with the Institution of Civil Engineers early in the month. Sir Wm. Matthews pointed to the advantages in the matter of professional training enjoyed by young engineers of the present day, in comparison with those of a former generation. The establishment of examinations had, he said, been regarded in some quarters as not entirely advantageous, but he claimed that the results had been satisfactory. Dr. J. H. T. Tudshery said forty candidates for studentship were examined at Manchester during the previous week.

Lancashire Iron Trade.—The Lancashire metal trade has been steadily decreasing in pig and manufactured iron for some time past, although the textile and general engineering manufactures show steady work and large profits. A good deal of iron and steel from the Continent finds its way into our markets and is offered at rates below those of English makers. Copper and tin have likewise been on the downward grade. Nobody ventures to speculate at present. Buying is all of the from hand to mouth character.

Electric Capstan.—Connected with the Manchester Ship Canal docks, in place of the usual hydraulic machinery, a powerful electrically-driven capstan has just been put down by a company from Gateshead at the new Sun corn mills of the Wholesale Co-operative Society, at Trafford Wharf. The capstan is of a more powerful type than is usually installed on dock sidings, and is intended for dealing with large quantities of grain. The same firm has also put down a still more powerful capstan for a large steel works at Sheffield, designed to handle bogies with 100-ton loads of billets. It has also been applied to battleships and for dockyard service.

The Coal Trade.—The coal trade of Lancashire continues firm. There has been no change in average quotations for house, steam, gas and shipping purposes since last September. From a Lancashire point of view, house coal has never been so dear within living memory. There have been fluctuations in the demand from time to time, but none of moment. Less shipping coal has been required during the last week or two; steam coal also has shown a slight falling off, and furnace coke is cheaper, but all classes of coal carried have maintained full rates. Colliery proprietors find the general demand so good that they are in a position of independence. The coal bills of the chief railway companies of the kingdom have gone up enormously during the latter half of 1907, that of the Midland showing an increase of £90,000 and the London and North-Western of over £150,000. Miners' wages, having gone up 15 per cent. during 1907, coupled with the prospect of an eight-hours day in mines, precludes any probability of a decrease in prices; in fact, an increase is spoken of should the Eight Hours Bill pass. In the Lancashire and Cheshire area of the Miners' Federation, the membership has risen from 34,000 to 72,000. Two additional agents have been appointed. Two of the list of agents are Members of Parliament, and the men are seeking to increase the number at a favourable opportunity.

THAMES.

(From our Own Correspondent.)

The Coming Port of London Bill.—What effect current legislation will have on this Bill, of which we have heard so much, it is, of course, impossible to say but a great deal is being made of the matter by the department from which it emanates, and the old adage probably applies that there is no smoke without fire. The principal points are now announced the Rivers Committee of the Council have had an interview with the President of the Board of Trade, and the matter is therefore, partly public property already. It is understood that the new port authority will not be a municipal one. There will be no compulsory acquisition of the docks at all but if terms are agreed upon and embodied in the Bill the Bill will render it obligatory upon the port authority to purchase upon these terms—that failing the settlement upon such terms before the Bill is passed the port authority will have power to acquire the undertakings by agreement. There will be provisions handling dues upon goods to be imposed similar to those in the bill of 1903. The new port authority will be enabled to continue the existing dues on shipping as doubled by the Thames Conservancy Act of 1905. Some licensing charge will be imposed on barges. The credit of the County Council would probably secure a reduction of ½ per cent. in the interest on the capital required, and as this may amount to £25,000,000 the desired guarantee would mean a saving of £127,000 a year. The reply to the Board of Trade was recommended as follows: That in view of the importance of the matter from a national point of view, the Government should join with the Council in the guarantee, and provided the Government was willing to join in the matter, the Council would be prepared to guarantee the interest on such stock, provided they are satisfied that the interests of ratepayers are safeguarded in the scheme to be embodied in the bill. The Council consider the risk is by no means a nominal one, the docks being a trading concern and liable to fluctuations due to strikes and competition from other ports, as well as the cost of improvements which may possibly be forced on the authority. The Council does not, therefore, see its way to bear the burden alone, and the only precedent, it is pointed out, is the Manchester Ship Canal, which involved a loan of £5,000,000 to the Canal Co. The opinion is expressed that London is the centre of the country, and trades are congregated here and that, therefore, it is not a local matter, the general trade being more concerned than is the case with another port. As it is understood, the Government concur in this proposal and the new authority will, therefore, be not so much a municipal one as would otherwise be the case. The Finance Committee of the Council concurs in the recommendation, and points out the necessity of the Government sharing in the risk, and the question of payment to the Dock Co. The voting at the Council resulted in a large majority for the proposals as outlined. As we go to press, the London and India Docks have accepted the Government proposals, and will be bought out for a sum of about £19,000,000. This is to be the recommendation of the directors to the proprietors, it is understood.

Greenwich Pier Litigation.—When the Thames Steamboat Act of 1904 was passed through Parliament by the late Council a mistake was made over the terms of acquisition of Greenwich Pier, with the result that the disastrous speculation is not ended by the sale of the boats themselves, the running including as it did the control of the piers. The contract in the case under notice included the purchase from the Greenwich Pier Co.; £21,000 was paid for the freehold for the position named, but without securing a full title. The Admiralty are trustees in the matter, and the present Council are endeavouring to remedy the mistake their predecessors made. The position of the matter is that at either end of the Council's freehold portion are two abutments which are vested in Greenwich Hospital, and these were leased to the Pier Co. in 1837 on an eighty years' lease, and when the pier was bought this lease went with it. Large sums are involved, the Admiralty holding the whip hand over this lease and desiring to put an end to the dual ownership, the point being put forward that a building might be erected which would be distasteful to them as trustees, the Government department having in their minds, no doubt the generating station near at hand. The Admiralty go to the length, it would seem, of demanding the surrender of the pier, the Council having to pay a rent besides up to 1917. In this way all the money spent on the pier will be absolutely lost. The present position is, of course, *sub judice* as regards the toll at this pier, and is before a Committee of the House of Lords, but it will be seen that the rush into municipal trading has in this case been a fatal one, and has involved great loss of ratepayers' money of which the issue is not even now by any means clear.

Royal Corps of Construction Dinner.—Officers of this department at the Admiralty and dockyards met recently under the presidency of Sir P. Watts to the number of over seventy. Among those present were Sir W. White, Prof. Biles, of Glasgow, and other well-known gentlemen. The importance of the constructive department of the Admiralty gives prominence to the matter.

River Foreshore Prices.—As showing the value of sites on the river bank considerable interest has naturally been taken in the price to be paid by the County Council in respect of premises required for the new County Hall from Messrs. Holloway Bros., who since 1900 have been the lessees of Victoria Wharf in the Belvedere Road, and for which they ask £230,000. The claim is based on loss of trade, removal and various items caused by the disturbance, and the firm say

they must remove as far as Battersea or Greenwich to get a wharf site again.

The Royal National Lifeboat Institution. — The annual meeting of this institution has recently been held, and was numerously attended under the chairmanship of Lord Balfour. The record for the year reads well. Besides 272 sailing boats there are under the institution's control four steam lifeboats, four motor boats and eleven steam tugs, making, it will be seen, a goodly array. The Prince of Wales was elected president, and the figures show that over £75,000 was received last year, of which more than £20,000 was from the Saturday fund.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

The Trade Outlook.—No new orders for ships have been booked at Barrow during the past month, and the general prospect is that but little business will be placed for some time to come. But there is no saying when certain features of prospective business may come to fruition, and in that event it is possible that a boom in shipbuilding will follow. This remark, of course, applies to some big business which has been in course of negotiation for some time past. The chance of booking good mercantile orders is very problematical, as the demand is very quiet, and many of the makers who devote themselves to this class of work are short of orders and are ready to quote low prices in order to maintain activity at their yards until a better market comes about. The prospects of getting orders for foreign warships is not at present very bright, although there are negotiations going on with several Powers, including Spain, which may some day bring orders to this country. There is also a chance of new work coming to hand from South American Powers outside of Brazil, for which country two large "Dreadnoughts" are at present being built, and one of these is in progress at Barrow.

Work in Progress.—Although the keel for the *Vanguard* battleship has not been laid at Barrow as yet, owing to the slipways being occupied with the Isle of Man steamer *Ben-my-Chree*, the work is well forward, and it is probable before March is out the keel will be officially laid, when the work of construction will proceed more rapidly than has been possible up to now. But the necessary material for the first portion of the ship is in hand, and as many men as possible are being put on to the job. Indeed, many shipbuilders in various trades have already found work at Barrow, and these have been drawn from other parts of the country where work is not at present plentiful. The date of the official placing of the contract for the *Vanguard* was the 2nd of March, and it is specified that the vessel shall be completed in two years from that time. This is about as soon as the contract could be completed under the most favourable of conditions, but the Vickers' firm are quite capable of completing their task within the specified time, and especially so as they are not fully supplied with orders. The Brazilian warship building at Barrow is not in a hurry, and full details of her construction are not coming to hand with that celerity which is essential for the rapid completion of the ship. But it is recognised now-a-days that not only is it advisable that ships should be built as quickly as possible, but that there is economy in this policy so far as mercantile tonnage is concerned, as the sooner a ship begins to earn money the better for her owners, while in the case of the Admiralty the sooner a ship is complete and in commission the better for all concerned. One of the features claimed for British shipbuilding is the celerity with which it can be done. This is undoubtedly a great asset on which the British Admiralty can always depend, and those firms which have orders in hand for the Government are always anxious to complete delivery as soon as possible, as it paves the way for other possible orders. The Isle of Man Steam Packet Co.'s steamer *Ben-my-Chree* was launched on the 23rd inst., and will be at once fitted up for sea at as early a date as possible, as she is wanted to go on her service by Whitsuntide. The Aberdeen floating dock No. 2, which is being built at Barrow, is expected to leave for the northern port on the 2nd of April in charge of tugs for a special voyage round by the north coast of Scotland. She is of the Clark & Stansfield type of dock, one of which exists in the docks at Barrow, and another is being built at Barrow for the Admiralty for submarine use. It is possible other orders for similar floating docks for the Admiralty will be built at Barrow in the early future. The only other order in progress of construction at Barrow at present, outside the submarine department, is the barge crane for Canada, so that there is now room for a considerable number of new orders on the slipways if they could possibly be got hold of.

Submarines.—This branch of the shipbuilding trade at Barrow is very busily employed, and in addition to the order for two of these interesting vessels for Japan, there are several submarines in various stages of construction for the British Admiralty. This branch of Vickers' works is a closed door, and those employed in it are sworn to secrecy. It is only really known what is going on, or what has been going on, when a launch takes place. During the month C16 submarine has been launched for the British Government. It is understood this is the last vessel of this class for the Government, but work is in progress on the D class, which embraces many improvements on the A, B and C classes of submarines previously constructed. The improvements which have been made in submarines of the Holland type since the first vessel was built at Barrow, suggested by the developments of science and experience have resulted in placing on the water a much more reliable boat than was thought possible when the Admiralty first entered on this new departure. And there is reason to believe that in course of time further improvements will suggest themselves, as in most other things, so that by degrees we may hope to secure really reliable craft to undertake sub-aqueous navigation. C14 submarine has been delivered to the Admiralty this month, and during April another submarine of the C class will also be delivered. The steamer Vickers, Son & Maxim are building to carry the two submarines to Japan is a peculiar ship. She is being so built that she can be used to carry any sort of cargo when not required for the purpose of delivery of submarine or other classes of small vessels.

Mexican Transport. — This smart cruiser-looking type of vessel will be ready early in April to leave Barrow and undergo her preliminary and special speed trials, after which she will proceed to Mexico, and there form a first contribution to what is expected will develop into a navy for this Republic. It is felt by several South American and Central American Powers that, seeing the way in which the navy of the United States and of Brazil are being developed, it will be necessary to arm themselves in some reasonable way against possible aggression, and probably this view of the position may lead to the placing of orders in this country with British builders which would not otherwise have come their way.

The Russian Cruiser "Rurik."—This cruiser is lying at Glasgow undergoing various minor alterations prior to her acceptance trials. The officers and crew are not at all disposed to leave this country any sooner than is absolutely necessary, as they are learning something all the while and they are in receipt of fuller pay than is the fact when they are at home. There is every reason to believe the Russian Admiralty will be eminently satisfied with their ship when she gets to Libau later on in the spring.

The L. & N. W. Passenger Steamer.—The *Rathmore*, built for the Holyhead and Dublin traffic, is being rapidly fitted up for service in the docks at Barrow, and in a couple of months she will be on her station. She has very fine lines and is evidently going to prove a very fast boat.

Engineering.—The engineering department at Barrow is at present very well employed, but it is evident there will need to be some new orders in some of the departments before long if the present rate of activity is to be maintained. This is one of the largest engineering establishments in the world, and takes a great deal of feeding with orders. Boiler makers are fairly busy, and iron and brass-founders have plenty of work, but steel-founders are quiet, although there are prospects of many new orders coming to hand.

West Cumberland.—There is nothing new to report about the shipbuilding trade of this district, but both the yards at Workington and at Maryport are doing a quiet steady trade, and there is reason to expect this will continue for some time to come.

Shipbuilding Material. The demand for shipbuilding material is quiet, and of late the mills have been at a

standstill for want of orders. Prices are low, but the tonnage of shipping under construction is comparatively small, and hence there is great competition for the orders which are on offer.

Hæmatites.—The hæmatite iron trade is in a very bad state, and orders are coming in slowly, while prices are at 62s. for mixed Bessemer Nos. net f.o.b., and warrant iron sellers at 61s. 7½d. net cash. Stocks remain very low.

Shipping.—Shipping is very quiet. The exports for the year to date have reached 115,182, compared with 204,047 tons in the corresponding period of last year, a decrease of 88,865 tons.

SOUTHAMPTON.

(From our Own Correspondent.)

The Royal Mail Steam Packet Company.—This Company will shortly take their flag into Norwegian waters. They have made arrangements to place their luxurious steamer *Amazon* in the pleasure-cruising service for the coming season. The *Amazon* will leave Southampton on July 30th and will make calls at Boulogne, Hull and Leith, before finally sailing for the Land of the Midnight Sun.

The contract with the Company for the West Indian inter-Colonial Mail Service was issued on the 5th March last, together with a Treasury minute approving it. The subsidy was increased from £17,500 to £25,000 annually and this amount is to be borne equally by the Imperial and Colonial Governments. The contract is for ten years, and in return the Company will provide a fortnightly service between Barbados and British Guiana, calling at Grenada and St. Vincent on the homeward voyage, also a fortnightly service between Barbados, St. Lucia, Dominica, Montserrat, Antigua, Nevis and St. Kitts, calling at Grenada and St. Vincent on the outward voyage.

Two new steamers are to be constructed for this service and they will embody all the latest improvements.

The Company have now completed the extensive alterations and additions to their laundry at Shirley and the laundry is now capable of turning out 80 to 100,000 pieces of linen per week, and will be able in future to deal with the linen from the steamers of the Company sailing from London and other ports in the United Kingdom, besides the usual linen from the mail steamers sailing from Southampton.

The North German Lloyd Company will maintain the weekly service from Southampton which they commenced in March last with the sailing of the *Kronprinzessin Cecilie*, and with this in view the *Kaiser Wilhelm der Grosse*, which has not been here for some time, will take up her position in the New York service after an extensive overhaul. The Hamburg American Line will also commence their regular weekly service from this port to New York during the present month.

Dock.—The site of the new wet dock, which Messrs. Topham, Jones & Railton are constructing for the London and South-Western Railway Co. now presents a very animated appearance. A long inclined plane has been constructed, terminating in a high jetty running out into the river Test to expedite the loading of the barges. As the material is excavated by the steam navvies, it is loaded into trucks and by means of a powerful wire ropeway they are hauled up on to the jetty and the contents discharged into the barges alongside. Part of the excavated material will be utilized in filling in the mud-banks at the back of the Public Baths and the remainder taken out to sea. Dredging operations are in full swing and a number of steam grabs are also busy along the river front, assisting in the removal of the old chalk retaining wall. A complete system of railway lines has been laid down, communicating with all parts of the site. Piles are being driven along the riverside, and some are of ferro-concrete and of very large dimensions. The dock will embrace an area of about sixteen acres and when completed will be dredged out to a depth of forty feet to enable it to accommodate the largest liners. The work is expected to occupy about two years and about sixteen hundred men will be employed on the undertaking.

Day, Summers & Co., Ltd., Northam Iron Works, Southampton.—The S.Y. *Sagitta*, which the firm have built for the Duc de Valençay to the order of Messrs. Camper & Nicholsons, Ltd., and which was launched in February last, is now under the big 60-ton sheers in the yard, having her engines and boilers fitted in place. She was towed round to Gosport about the end of March. This yacht is the largest and most powerful steam yacht yet built in the South of England, her tonnage is 800 tons B.M. and the triple-expansion engines have been designed to indicate 1,250 I.H.P. It may be of interest to mention that the firm undertook to have the new engines and boilers ready for delivery on the 9th March; the first boiler was lifted on board on March 10th and the second boiler on March 12th, and the main engines on March 13th. The set of triple engines and boiler which the firm have constructed for an Australian House were shipped last month. The S.Y. *Sapphire*, 1023 tons, owned by the Duke of Bedford, which is at the yard for fitting out, was docked and painted at the end of last month. The S.Y. *Maund*, 900 tons, owned by Mr. Mortimer Singer, sailed the early part of last month for the Mediterranean, after having a large amount of work carried out on her, including painting inside and out. Both the tugboats which the firm are building for foreign owners are in frame and the machinery for both is in a forward condition. The s.s. *Valmaseda* sailed the last day of February, after having had considerable machinery repairs carried out. The firm were successful in anticipating the contract date for completion by fourteen days. The following yachts are fitting out at the yard: S.Y. *Medusa*, S.Y. *Hiawatha*, S.Y. *Madrigal*, S.Y. *Assagai*. Both slips at the yard have been kept fully occupied lately with various vessels going up for painting and other work, including the pleasure steamer *Lord Elgin*, belonging to the Bournemouth Co. The firm have also in hand a number of turbine castings for J. Saml. White & Co., Ltd.: they have turned out upwards of 130 tons of similar castings and have been very successful with them.

HULL.

(From our Own Correspondent.)

Work in Docks.—The outlook at this port, so far as business generally is concerned, is anything but bright, and were it not for the fact that the Argentine grain exports are practically certain to send considerable tonnage into the Humber in the immediate future, little would be doing in the way of shipping outside the regular liner trades, and even the regular liners are already feeling the effects of the depression in trade prevailing at the moment. Fortunately a large volume of dry-docking and repair work has been and is presently being carried out in the port, labour being both good and plentiful and prices very reasonable. Moreover, the Alexandra Dock here offers every facility for the dry-docking and repairing of all classes of tonnage, the dock being equipped with two of the finest dry docks on the East Coast, and work is carried out both with economy and despatch. A better tone will doubtless prevail here all round after the Baltic is open to navigation, and when the South Yorkshire colliery owners assume a more conciliatory attitude when negotiating for prospective business.

Amos & Smith are fairly well employed with repair work, they also have a few orders in for new machinery, but enquiries for new machinery are very few.

Cooper & Co. and The Hull Central Dry Dock and Engineering Works are both full up with large repair work, which is a good job, or a very large number of men would be walking the streets.

Earle's Shipbuilding and Engineering Co., Limited, Hull, have, since the last report, received an order for four fleeters and machinery for ships in course of construction. They also have a fair amount of repair work in hand, but have facilities for doing a much larger business, both in the construction and repairing departments. The shipyard, engine works and boiler shops are fully equipped with the latest fast-running machinery, and are capable of dealing with the heaviest class of work as regards ships, engines and boilers. The tidal docks and patent slips enable the company to undertake all classes of repair work with exceptional rapidity and economy.

BELFAST.

(*From our Own Correspondent.*)

Messrs. Harland & Wolff.—On 3rd March, there was launched from the Queen's Island the mammoth liner *Rotterdam*, built for the Holland-America Company. The new vessel is 668 feet long by 77 ft. 6 in. beam, and has a gross tonnage of nearly 25,000 and displacement of close on 40,000 tons. Everything that the heart of the traveller can desire will be embodied in the fitting out of this steamer's luxurious accommodation. Amongst other novel features to be introduced may be mentioned the fish pond, from which passengers may secure a constant supply of fresh fish. This vessel was originally to have been sent from the stocks on 22nd February, but, owing to unforeseen circumstances, over which the builders had no control, the launching had to be postponed. On 1st March, the large sailing barge *Navahoe*, built by Messrs. Harland & Wolff for the Anglo-American Oil Company, left Belfast Lough in tow of the oil tanker *Iroquois*, which vessel was also constructed recently at the Queen's Island for the same owners. The *Navahoe's* gross tonnage is about 8,000 tons, and she has carrying capacity for 10,000 tons of oil in bulk. She has a complete installation of auxiliary machinery, and is also fitted with Marconi's wireless telegraphy system. The fitting out of the *Navahoe* was completed some weeks since, but the vessel has since been laid up awaiting the arrival of the *Iroquois* to tow her across the ocean. Lord Pirrie's belief in the advent of the "1,000 feet steamer" has more than once been referred to in these columns, and it is more than probable that his firm will in the near future have the tackling of a vessel of such dimensions. One of the building slips at the north end of the yard is being lengthened to such an extent as will make it suitable for the construction of a leviathan of 1,000 feet.

Messrs Workman, Clark & Co.—Since last month's notes were published, this firm has completed the fitting out of the twin-screw vessel *Ancona*, built by them for the Italia Steamship Company, of Genoa. After a series of successful trials on the Skelmorlie mile, the steamer returned to Belfast to have a few finishing touches put to her, and she has since left to take up her running in the company's passenger and cargo service between Genoa, Naples and New York. The *Ancona* is 500 feet long, with a gross tonnage of about 8,900. Whilst coming up the Lough, on the return from the Clyde, the liner ran into and sank the Harbour Commissioners' twin-screw tug, *Musgrave* which was in attendance. Fortunately the disaster was not accompanied by loss of life. Salvage operations are proceeding, and it is probable that before these notes are in print the tug will have been raised and dry docked for repairs. Messrs. Workman, Clark & Co. have several other vessels nearing the launching stage, amongst which may be mentioned a sister ship of the *Ancona* referred to above. Messrs. Workman, Clark & Co.'s connection with the Lloyd Brazileiro has ended in a big lawsuit, in which the former are the plaintiffs. They were awarded a sum of £113,150 on a contract for the building of three vessels which they had contracted to build for the defendants. The Lloyd Brazileiro appealed against the decision, but the higher court upheld the award. The plaintiffs seized two new ships, which were in the hands of the Sheriff, and later the defendants applied for a stay of execution in view of an appeal to the House of Lords. The application was granted, on payment of £50,000 into court the Sheriff in the meantime to remain in possession, the applicants paying the Sheriff's expenses.

T.S.S. "Duke of Albany." This fine new vessel, which was built by Messrs. Brown & Co. for the Belfast Fleetwood mail route (under the joint control of the Lancashire and Yorkshire and the London and North-Western Railway Companies), arrived in Belfast on her first trip from Fleetwood on 5th March. The *Duke of Albany* was open to the inspection of numerous invited guests, and nothing but praise was heard both for the general appearance of the vessel and for her luxurious accommodation.

The M.P. and the Harbour Board. Mr Joseph Devlin, M.P., recently made a second attack upon the Belfast Harbour Board in the House of Commons and for the second time the Board came out an easy first, and Mr. Joseph Devlin nowhere. Mr Devlin's questions in the House amounted to a charge that Sir Thomas Dixon and Mr. James M'Connel had used their membership of the Harbour Board to secure for their respective firms contracts for the supply of goods and material to the Board. Had there being any truth in the suggestions contained in Mr. Devlin's questions, the entire Board would have been involved in a charge of conspiracy. But Mr. Lloyd George's written replies to Mr. Devlin proved that there was not a shadow of truth in the latter's implied assertions. They, the replies, contained the information that during Sir Thomas Dixon's absence from the Board a contract was given to his firm, Messrs Thos. Dixon & Sons, Ltd., for slates and cement on the lowest tender. Immediately Sir Thomas was made aware of this fact, he not only asked for the contract to be cancelled but undertook to indemnify the Commissioners against any extra cost in obtaining the material elsewhere, and this notwithstanding the fact that his firm was quite entitled to tender and accept contracts, provided that Sir Thomas took no part in the giving out of these contracts and did not attend the meeting at which the settling of this business was dealt with. Then, as regards Mr. M'Connel, the reply in his case was that to the knowledge of the board, Mr. M'Connel's firm had never at any time been contractors, sub contractors or agents for the supply of cement or other goods to the Board, or received any payment for them, although it is equally permissible for this firm, being a limited company, to tender and take contracts.

Irish Coal. There arrived in Belfast recently the s.s. *Glentow* with the first cargo of coal from the Ballycastle mines. The coal appears to be of good quality, and the mining company's operations are likely to be attended with success. There is also an extensive deposit of clay highly suitable for the manufacture of fireclay goods, so that the company is not altogether dependent upon its output of coal.

HENRY BELL THE PIONEER OF THE PASSENGER STEAMBOAT IN EUROPE.—Glasgow Municipal Art Galleries, at Kelvin Grove, have been enriched recently by an extremely valuable portrait in oils of Henry Bell, by the Scotch artist, James Tannoch. The portrait which we have the privilege of reproducing, is the gift of Mrs. John Ross, junr., and derives a special value from the fact of its being the only

Henry Bell's Monument in Row Parish Churchyard.

original portrait of Henry Bell that exists. He was born at Torphichen, Linlithgowshire on April 7th, 1767 and died Nov. 14th, 1830, at Helensburgh Dumbartonshire. He was buried in the churchyard of the Parish Church at Row, and over his remains and those of his wife, a monument was erected by the well known Clyde engineer Robt. Napier,

as a token of appreciation. The story of the *Comet* is too well known to our readers to require repeating, save to say that she was about 43 ft. long by about 12 ft. beam and 5 ft. 9 in. deep, with a tonnage of about 25 tons, and accommodation for forty passengers. She was built at Port Glasgow by John Wood, and began to run on the Clyde in 1812. The engine was made by John Robertson, Glasgow. The cylinder was $12\frac{1}{2}$ in. diam. by 16 in. stroke, and of four nominal horse power. The boiler was made by David Napier. A speed of about 5 knots per hour was attained. We are indebted for a photograph of the original painting to Mr. W. Rose Duthie, 56, Eldon Street, Glasgow.

JUNIOR ENGINEERS.

XVIII.*

Machine Shop.

WHERE, as in most of the marine establishments, the present disposition of the works has been evolved upon the original site, the arrangement of the shops and machines may not conform to the economic conditions under which modern plant has been designed, but, as various tools

* For Articles I. to XVII. see previous issues.

Photo by Wm. Rose Duthie Glasgow.

Henry Bell.

are pressed out of service, the tendency is always to lay out new erections by more systematic methods, and to gradually reduce the inconveniences to which the organization may have been subjected.

The motive power has passed through various changes, in some cases from water wheels, in others from a number of small steam engines spread over the works, and has been in many instances now concentrated in a single power house with either electric or direct drive. The direct drive is more in favour as obviating the losses due to transforming and reducing the possibility of breakdown. The prime movers may be placed at the end of the main line of shafting, with gear or belt-driven counter shafts, and the pneumatic, hydraulic and electric power can be transmitted thence throughout the works.

Although steam has so far held the field, the gas engine is making a bold bid for supremacy, and as defects have gradually been eliminated, and causes of breakdown guarded against, its load factor has been raised, till now it can equal that of the steam engine.

Whatever advantages the direct drive on line shafting may possess, the system of providing a separate motor for every individual or range of machines has something to recommend it, principally that with a day and night rush on one job, the machine in operation can be kept going without running the whole of the shop shafting, and the breakdown of a motor does not necessitate the stoppage of all, although this possibility is proportionately increased with the greater number of motors.

With the line shafting system the tendency is to maintain a high driving speed and transform to slower speeds on the counter shafts, thus reducing the weight of shafting, or with an existing line increasing the transmitted power. With the slower speeds the brass bearing was efficient enough, but the higher rate necessitated something more suitable and thus a wide field has been opened up for the roller bearing. Of the many types of ball and roller bearings on the market, the Hyatt flexible roller appears to be the most suitable, as, with light shafting, the bending effect of a series of pulleys is taken up by the spring of the rollers. The bearing consists of a number of rollers, each of which extends the full length of the bearing, fitted into a brass cage having stopper collars at either end, the whole working in a steel bush; each roller is formed from a single length of rectangular bar steel, which is wound into a spiral, so that it is virtually a spring which adjusts itself to the shafting, thus giving a bearing surface of the full length. The rollers are alternately right and left-hand spirals, thus assisting the distribution of the lubricant.

Rope transmission is still largely employed from the engine to main shafting and for long drives, the pulley rims are cast as a series of grooves into which are fitted leather or wood strips to reduce the wear on the rope by increasing the resistance to slipping. Where leather belts are used, as is still the case for machine and countershaft drives, the ends are joined by lacing with thongs or by means of metallic fasteners, of which there are innumerable varieties more easily applied than the lace. Leather link belts are employed, where a high speed is to be maintained on small pulleys, consisting of several rows of links, a few inches long, riveted together; this belt can be made of any length or breadth and can be formed to suit the cross curvature of the pulley face or hinged at mid-breadth. For most drives the plain leather belt has been superseded by the cotton variety either woven throughout or made up of layers of fabric sewn together or cemented with rubber solution. Latterly with the introduction of speed and feed change boxes, a more positive action has been secured for short drives by adopting chains on cogged wheels.

With the original erection of lines of shafting solid pulleys could be slipped on and keyed, the ends of the shafting being joined with muff couplings, but, as other drives are from time to time added, built pulleys either of light steel or wood are fitted in halves; the latter has come largely into favour and consist of a number of layers of segments glued together, the two parts of the pulley are bolted over the shaft, to which they are securely gripped by a tapered cylindrical wedge driven hard in between the nave of the wheel and the shaft.

When a machine has to be stopped from any cause, the belt is either thrown over on to a loose pulley on the counter shaft, or the friction clutch, if fitted, is put out of gear. The clutch consists of an outer shell pulley, revolving idly on the shaft, inside which is a metallic band which ordinarily is clear of the inner rim, but, when the lever is put over, is pressed hard against the face, and thus, being keyed to the shaft, transmits the power from the belt. The band is operated by means of two pairs of levers worked from a sliding sleeve on the shaft. Various types are on the market, operating on this principle, which have displaced the conical grip, owing to the end thrust in the shaft produced by the latter.

Where fast and loose pulleys are employed, the loose pulley is frequently made slightly smaller in diameter to allow of the belt contracting when not in use, thus reducing the strain and preserving its tautness.

As regards the general arrangement of the machines, the ideal system is to group all those of each class together, drillers in one section, planers in another and so on. This is, of course, not always possible, although it has undoubtedly many advantages. As the planing of one job is completed it can be transferred to the drilling section, irrespective of any particular machine, and placed upon the first of those ready for it; the number of operatives can be reduced, for, as a rule, parts can be set up and adjusted on one machine while another is in operation with automatic feeds; transit rails can be more advantageously employed; special tools, attachments and grinders are more localized, and the best possible results are obtained by the specialized aggregation of the individualities of the operatives.

FACULTY OF COMMERCE.—The co-operation of business men with the senatus of a University in order to organize a series of classes and lectures with a view to train men for commercial life ought to produce good results, and we have pleasure in calling attention to a circular issued by the secretary setting forth the objects of the Faculty of Commerce of the University of Birmingham. The co-operation referred to is extended to the University through the medium of an Advisory Committee, and the circular in question has been endorsed by the members of the committee, with the intention of getting into touch with firms throughout the country, and of obtaining a larger outlet for the students who have passed through the prescribed course, and are in some measure trained in the theory and principles involved in the science as well as the art of commerce. The minds of the students are thus made more receptive to grasp, with the teaching of experience, the details of any business they may be called upon to deal with. The course embraces subjects, the study of which is calculated to prepare the student for positions of trust and responsibility. The prescribed course of study embraces three years, and is covered under the heads, 1, Commerce, 2, Accounting, 3, Finance. I. Deals with the condition of trade and the chief industries in the leading countries of the world, with up-to-date history of the various industries of each nation, and the geographical features which tend to favour or militate against these. Economic analysis forms a special study, as a concrete branch of political economy along with a course of lectures on the economics of transport, and both land and sea-borne traffic are considered and discussed. Following on from these, the third year students are brought to see the importance attaching to location of works, cost of production, method, limited companies, works management, labour, advertising, etc. II. Deals with bookkeeping and methods of dealing with accounts, computations, costs and balance sheets. III. Deals with banking, money market and foreign exchange; stock exchange, Government and municipal credit and finance. Under each of the headings a course of most interesting lectures and papers could be given, admirably suited to the wants and requirements of modern trade and commerce, and we are assured from a perusal of the pamphlet and circular received that in the class-rooms of the University of Birmingham the divisions of the subjects are dealt with in a manner both interesting and instructive.

SAINT JEAN.—On March 10th, the screw steamer *Saint Jean* (of which we give particulars in this issue), built by the Société des Ateliers et Chantiers de France, Dunkerque, was taken to sea for her official trials. Notwithstanding the rough weather the vessel maintained an average of over ten knots throughout a four hours' trial.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES English.

Ruth.—On February 20th, Mr. William Walker, of Maryport, launched a steel screw coasting steamer to the order of W. Butler Wang, Esq., of Tonsberg, Norway. The dimensions are as follows:—Length between perpendiculars, 160 ft.; breadth moulded, 28 ft.; depth moulded, 13 ft. 1½ in. She will be fitted with triple-expansion engines built by Messrs. Hutson & Sons, Ltd., Kelvinhaugh Engine Works, Glasgow, having cylinders 13½ in., 21½ in. and 34½ in. by 27 in. stroke, and boiler 13 ft. diameter, 9 ft. 6 in. long by 160 lbs. working pressure. The vessel is built to the highest class at Lloyd's and is intended for the general coasting trade. She was christened *Ruth* by Mrs. L. R. Brodie, of Johannesburg.

Rathmore.—On March 3rd, this vessel was launched at Messrs. Vickers, Sons & Maxim's to the order of the London and North-Western Railway Co., and is intended for the passenger service between Holyhead and Irish ports. She is unlike the two previous ones launched the previous months, for they were intended for the intermediate service—specially produce and live stock. The launching ceremony was performed by the Hon. Mrs. Grant, daughter of the chairman of the L. and N.W. Co., Lord Stalbridge, who was also present. In connection with this important addition to their fleet the railway company, instead of going in for a sensationally high speed, have the intention of ensuring with the minimum dimensions 20 knots under all weather and sea conditions, with freedom from vibration and with accessories to ensure comfort which are too often curtailed to decrease weight in the interests of speed. The provision of large cabins and saloons, adequate artificial as well as natural ventilation, extensive heating arrangements as well as complete electric lighting has been a primary consideration. The limiting of speed, too, will admit of a considerable quantity of cargo being taken, and a few cattle, horses, etc., so that with fuller lines and deeper service draught the vessel will be steadier in a seaway. The dimensions of the *Rathmore* are as follows: Length overall, 310 ft.; length between perpendiculars, 299 ft.; breadth moulded, 40 ft.; depth to main deck, 15 ft. 6 in.; number of passengers, 1000. In addition to the main and lower decks, which extend right fore and aft, there is a forecastle, bridge and poop deck, and over the central part again a boat deck, thus a large promenading space is provided. On the bridge or promenade deck there is, in addition to the main entrance to the first-class quarters a ladies' saloon and lounge, which latter, like the smoking-room further aft, has for the main decorative feature a high-dome skylight. On the next, the main deck, there is extensive state-room accommodation. Centrally located in the fore and aft line is the dining saloon, with seating accommodation for fifty passengers and having contiguous to it large kitchen, pantries and stores. Further aft is another ladies' saloon and adjacent to it state-rooms for ladies. On the lower deck there are more state-rooms, all well lighted, ventilated and heated or cooled, according to the season. Indeed, in these and other passenger conveniences the best practice adopted in large ocean steamers has been followed. The third-class passengers are accommodated aft, and there are included ladies' saloon and dining-room on the main deck, with a lounge and smoking-room in the poop deck house, which serves also as the entrance to the third class quarters. A deck house for the quarters of the captain and officers has been built on the boat and poop decks, and the crew is berthed on the main and lower decks forward. Stalls for horses and cattle are fitted up on the main and lower decks and are completely isolated from the passenger quarters. The vessel is fitted with steam winches and derricks for the quick handling of cargo. A powerful steam windlass and capstan is fitted forward, and a large warping capstan aft. The vessel will be steered by a steam steering gear, controlled from the forward wheel house and after bridge by telemotor gear. Hand steering gear is also provided. Six boats are placed on boat deck and a large number of buoyant deck seats are also provided to meet the Board of Trade requirements for life saving. A complete installation of electric lighting is arranged. A system of both natural and mechanical ventilation has been carefully worked out. Steam heating is fitted throughout all living spaces. In addition to the water ballast tanks in the forward and after peaks large water ballast tanks are built in the forward and after holds to assist in steadying the vessel in rough weather. The propelling machinery consists of two sets of four-crank triple-expansion engines, each set having one high pressure cylinder 25 in. diameter, one intermediate cylinder 37 in. diameter, and two low-pressure cylinders 41 in. diameter, the stroke in each case being 30 in. The engines and propellers are designed to obtain freedom from vibration. Steam is supplied at a working pressure of 180 lbs. per square in. by two double-ended and two single-ended cylindrical boilers, the double-ended boilers being 20 ft. 6 in. long and the single-ended boilers 10 ft. 6 in. long, while the diameter of all three is 13 ft. 6 in. All the boilers are arranged to work under forced draught with closed stokeholds, three large fans being fitted for supplying air under pressure. The condensers are cylindrical in form placed in the wings of the ship, the circulating water being supplied by two centrifugal pumping engines. In addition to the usual feed and bilge pumping engines there are included in the machinery department, filters, heaters, fresh-water pumps, ash hoisting engines and ash ejectors, the equipment generally embodying the latest practice for cross-Channel steamers. The machinery, like the hull, has been built to the requirements of the Board of Trade and Lloyd's Registry of Shipping.

Onward.—On March 4th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw carrier, the principal dimensions being 142 ft. by 22 ft. 3 in. by 11 ft. 9 in. moulded. The vessel has been built to the order of Messrs. The Great Northern Steamship Fishing Co., Ltd., of Hull, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull, and is replete with all the latest improvements for this class of vessel. As the vessel left the ways she was gracefully christened the *Onward* by Miss Gertrude Hall, of Hull, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Xerxes and **Sussex County.**—On March 8th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 125 ft. by 22 ft. by 12 ft. 10 in. moulded. The vessel has been built to the order of Messrs. The Hector Steam Trawling Co., Ltd., of Swansea, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Xerxes* by Mrs. Nosworthy of Swansea. Immediately after was launched a steel screw drifter of the following dimensions—84 ft. by 18 ft. by 9 ft. moulded, built to the order of Captain W. Lucas, of Lowestoft. She will be fitted with compound surface condensing engines by Messrs. Crabtree & Co., Ltd., of Great Yarmouth, and is replete with all the latest improvements for this class of fishing. As the vessel left the ways she was gracefully christened the *Sussex County* by Mrs. Crabtree, of Great Yarmouth, after which the parties adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Trawler.—On March 7th a new steam trawler built to the order of the Crown Steam Fishing Co., Ltd., of Grimsby, was launched from the yard of Earle's Shipbuilding and Engineering Co., Ltd., Hull. The dimensions of the vessel are:—Length, 135 ft.; breadth, 23 ft.; depth, 13 ft. The vessel has been built under Lloyd's survey for 100 A1 class steel, and is provided with the usual trawling outfit and constructed with a raised forecastle to encounter heavy weather. The machinery will consist of a set of triple-expansion engines, having cylinders 12½ in., 22 in. and 36 in. diameter by 27 in. stroke, steam being supplied by a large single-ended cylindrical boiler working at a pressure of 180 lbs. per square inch. The naming ceremony was performed by Miss Ethel Bryant, of Grimsby, and amongst those present were Miss Olive Bryant, Mrs. Sturrock, Mr. J. Bryant, Mr. J. Walker and Mr. F. Somerscales. This is the forty-fourth vessel built by Messrs. Earle's for companies with which Messrs. Moodys & Kelly are associated.

Deux Freres.—On March 13th there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner & Co. Ltd. at Bill Quay, Newcastle-on-Tyne, a new steel screw steamer which has been built by them to the order of Messrs. Bretel Frères, of Valognes. The vessel is of the well-deck type with long poop and bridge combined, also topgallant forecastle. Water ballast is provided in double bottom under cross bunker and in the fore peak tank. The vessel will be rigged as a two-masted schooner and will be fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo. The machinery, which is of the improved triple-expansion type supplied with steam by a large steel multitubular boiler, has been constructed and will be fitted by Messrs. North Eastern Marine Engineering Co. Ltd. of Wallsend-on-Tyne. Both the ship and engines have been built to the requirements and under the special survey of Lloyd's for their highest classification and have also been superintended during construction by Mr. C. Collet, of Liverpool. As the vessel left the ways she was gracefully christened *Deux Frères* by Mrs. Wood, wife of Mr. Wm. Wood, chairman of the directors of Messrs. Wood, Skinner & Co., Ltd.

Ben-my-Chree.—On March 23rd, what promises to be the fastest Channel steamer was launched from the Naval Construction Works at Barrow-in-Furness of the Vickers' Co. This vessel was named the *Ben-my-Chree* and has been designed and built by the company for the Liverpool and Isle of Man service of the Isle of Man Steam Packet Co. Ltd. She will maintain in service a speed of 25 knots. To this end she will be fitted with very powerful machinery of the Parsons turbine type, constructed by the Vickers' Co. and embodying all the latest improvements in design and construction, and to ensure a high manœuvring efficiency even in adverse weather. This will be the third turbine steamer on the Isle of Man service, the others being the *Viking* and the *Manxman*, the latter also a Vickers-built steamer. But these vessels do not exceed 22½ knots in service, and at present 24 knots is a very exceptional speed in Channel service and has only been excelled on the ocean by the *Mauretania* and *Lusitania*. Another outstanding feature in connection with the *Ben-my-Chree* is the extent of the passenger accommodation. She will carry 2500 passengers and as everything has been done to conduce to seaworthiness, steady running and reliability, as well as comfort and speed, there is certainty that in the season this accommodation will be severely taxed. The *Ben-my-Chree* is 40 ft. longer, 4 ft. broader, and will carry 550 more passengers than the *Viking*, besides being quite 2½ miles per hour faster. The principal dimensions of the vessel are:—Length overall, 390 ft.; length between perpendiculars, 375 ft.; breadth, 46 ft.; depth to main deck, 18 ft. 6 in. The vessel has been built under special survey of Lloyd's and also in accordance with the requirements of the Board of Trade for their passenger certificates. The vessel has five decks, *viz.*, lower, main, shelter, promenade and boat decks. There is ample room for enjoying the sea passage, as the promenade deck extends for over two-thirds of the vessel's length, and is carried out to the ship's side, and by way of protection in inclement weather there is a boat deck above it extending for about half the vessel's length. The shelter deck is carried right fore and aft, and on each side there is a fine promenade. The centre of this deck is given up to cabins and public rooms, while on the two decks below—the main and lower—there are additional public saloons. The first-class passengers will occupy the forward part of the ship, and the second-class passengers the after part. There is an exceptionally wide companion way forward communicating with all decks from the promenade to the lower decks, a range in height of between 40 and 45 ft. On the shelter deck there will be the main entrance to this stairway. On the promenade deck, which will be the centre of attraction in fine weather, there has been built a spacious tea-room with buffet attached. It is panelled in silver grey sycamore and mahogany and will be the most popular resort in the ship. The ladies saloon or lounge below will prove a strong competitor for the ladies' favour; it is finished in satin wood and walnut. For the more exclusive devotees of smoking there is a large smoking saloon, with adjacent bar, in the after part of the deck-house on the shelter deck. There is on the main deck a large saloon 80 ft. long and 46 ft. wide, lighted by large patent rectangular windows, well ventilated, panelled in mahogany with carved pilasters, and furnished in a manner conducive to ease and comfort. Adjoining this large compartment is a ladies saloon more brightly decorated in satin wood and maple. On the lower deck there is a dining saloon with seating accommodation for about 120 passengers. This saloon will have a handsome appearance having mahogany dado with oak panelling above. In addition to the special ventilating arrangements throughout the ship there will be in this saloon seven electric table fans. There is a large pantry fitted up with bain maries, carving tables, etc., at the after end of the dining-saloon, with lifts from the galley overhead. There are ice house and vegetable stores adjacent to the cuisine department. At the fore end of the dining-saloon on the lower deck a lounge is provided for first-class passengers; it is fitted up with sofa berths and panelled in maple and mahogany, and there are eight special private cabins in a house on the shelter deck. The second-class accommodation is at the after end of the vessel. There is a large saloon on the main deck and a dining saloon on the lower deck, forward of which is a ladies' saloon. A large buffet and bar has also been provided for the use of second-class passengers. The lavatory accommodation is on an extensive scale, alike for first and second-class passengers. Every provision has been made against accident. The vessel is sub-divided into a large number of water-tight compartments so proportioned that the ship will float with any two adjacent compartments flooded with water. The water-tight doors throughout the ship are operated on the Stone-Lloyd system, which enables all the doors to be closed instantly and simultaneously from the bridge. Water ballast tanks are provided at each end of the vessel, so that she can be trimmed to any draught. There are also large water ballast tanks in the holds for trimming the vessel in order to steady her in rough weather. Great consideration has been given to life-saving appliances, and there will be twelve boats, ten of which will be of large capacity, and each is fitted with patent disengaging gear. A powerful steam windlass and capstan is placed forward on the shelter deck for working the anchors, which are arranged to stow in the hawse pipes. Two large steam capstans are fitted on the shelter deck aft for warping purposes. A combined steam and hand-steering engine is located aft, and this is controlled by telemotor gear from the navigating bridge. There is also a powerful steering gear forward for operating a bow rudder introduced to facilitate the quick turning and manœuvring of the vessel when entering or leaving port. The vessel has a complete installation of electric light. The generating plant is in duplicate, each being capable of supplying the electric current for all the 350 lamps of 16-candle power. A searchlight projector is placed in the bows of the vessel. A system of electric bells is also fitted. The propelling machinery consists of three sets of steam turbines of the Parsons type, driving three shafts with one propeller on each of the shafts. The turbines which have been manufactured by the Vickers Company, are arranged to work in series, with one high-pressure ahead-turbine driving the centre shaft and two low-pressure ahead-turbines, one on each wing shaft. Astern turbines are incorporated in the casing with each low-pressure turbine, suitable valves are fitted for promptly controlling the steam admission for ahead and astern working. These manœuvring valves are independent of the high-pressure turbine, which latter will run idle when the vessel is manœuvring. The valve gear is specially arranged for easy manipulation, and is placed at the forward end of the high-pressure turbine. The main valves are of the vertical equilibrium type with large handwheels. There are two condensers of the cylindrical type placed one on each side of the turbine run. They are supplied with circulating water by two large centrifugal pump engines. The air pumps are of the direct-acting twin type fitted in duplicate for each condenser, and driven by independent engines. Steam is supplied to the turbines at a pressure of 170 lbs. per square in. by four large double-ended cylindrical boilers arranged to work under forced draught with closed stokeholds. Each of the boilers is fitted with eight furnaces of the suspension type; there are four combustion chambers each common to two furnaces; the shell plates and stays are of high tensile steel. The boilers are arranged in two boiler rooms with separate uptakes and funnel for each room. Four steam-driven fans are fitted for supplying air under pressure to the boilers. In addition to the usual feed and bilge pumping engines, the machinery department is fitted with oil lubricating pumps for the

turbine bearings, sanitary pump and a Cochran (Annan) donkey boiler with patent seamless furnace, feed-water heater, silent ash hoists and fresh-water donkey, etc. The equipment generally embodies the latest up-to-date practice for this class of steamer. The machinery has been built to the requirements of the Board of Trade and Lloyd's Registry of Shipping. Finally, with her two funnels and two masts, which are schooner rigged with fore and aft sails, and with a fine sheer and smart rake, the vessel will suggest her high speed even when at anchor.

LAUNCHES—Scotch.

Iolanda.—On March 4th, this very fine vessel of about 2,000 tons Y.M., built to the order of Commodore Morton F. Plant, from designs by Messrs. Cox & King, naval architects, of London, and under their superintendence, stated to be the second largest privately owned yacht in the world, was successfully put in the water by her builders and engineers, Messrs. Ramage & Ferguson, Ltd., at Leith, and is to be completed forthwith. It is admitted with regret that she will not be added to our own yachting fleet, but at once hoists the Stars and Stripes, though there is some consolation in the fact that she will also carry the house flag of Commodore Morton F. Plant, who, as the popular owner also of the racing schooner *Ingomar*, is well known to yachtsmen here as he is on the other side of the Atlantic. In the unavoidable absence of Mrs. Plant, the launching ceremony was gracefully performed by Miss Harding, of New York City, in the presence of the Commodore and a party of friends. The name *Iolanda* would seem to be happily chosen, being, we are informed, that of many Princesses of the Italian Royal house, and *Iolanda* should at least prove a princess of the sea. The principal dimensions of the yacht are: Length overall, about 305 feet; beam, 37 ft. 6 in.; depth, 23 ft. Her twin-screw machinery is of the triple-expansion four-crank type of 3,000 to 4,000 I.H.P. One of the features is that her boilers are partly cylindrical marine return tubular and partly water tube. This combination, the first installed in any yacht, affords the special advantage of being able to raise steam and get under way at practically a moment's notice, or provides additional speed at short notice, when required, while the bunker capacity of some 550 tons gives the yacht a very extensive ocean steaming radius. Needless to say, everything possible is provided to render her thoroughly up-to-date, including motor and steam launches, quick-firing guns, an elaborate system of electric lighting, which is accredited as being the largest ever installed in a private yacht, and includes arrangements for manipulating the Marconi installation of wireless telegraphy. The heating system throughout the yacht is by steam. The refrigerating plant, with cold chambers, etc., has been very carefully considered, and has very large storage capacity, including fish stores, dairy, etc. A spacious laundry is being fitted up on the orlop deck, the laundry machinery being worked by electric motors. A very comprehensive system of ventilation is being installed, some thirty motor-driven centrifugal fans being employed in this service. The accommodation for owner and guests comprises drawing and dining rooms, library, smoking room, and other saloons, with owner's state-rooms and many guests' rooms, bath rooms, etc., superbly fitted throughout; the general idea of style being Queen Anne and Early Georgian. The officers', servants' and crew's quarters, are also very spacious, and arranged to accommodate about eighty persons.

Waitemata.—On February 28th, there was launched at Port Glasgow by Messrs. William Hamilton & Co., the steel screw steamer *Waitemata*, built to the order of the Union Steamship Company of New Zealand. The vessel, which is built to Lloyd's highest class, under special survey, is of the following dimensions: Length, 430 ft.; breadth, 54 ft., depth, 30 ft. 4 in., and is designed to carry 8,500 tons dead weight. As the *Waitemata* will be employed in the Fiji and Calcutta trade, the 'tween decks have been fitted up for the carriage of cattle and horses. All the latest appliances for the rapid handling of cargo are fitted, including thirteen large steam winches. After the launch the vessel was towed to Glasgow where machinery will be fitted by Messrs. Dunsmuir & Jackson. This consists of a set of triple-expansion engines and three single-ended marine boilers, having a working pressure of 180 lb., fitted with Howden's forced draught. Wailes, Dove and Co.'s bitumastic covering to the tank top in boiler space and their bitumastic enamel to the bunkers and ships' sides in boiler space. The naming ceremony was performed by Mrs. J. R. Campbell.

Hock Lee.—On March 4th, there was launched at Paisley by Messrs. Bow, M'Lachlan & Co., the steamer *Hock Lee*, built by them for Eastern owners. The vessel has been constructed to the highest class in the British Corporation. Accommodation is provided on the main and upper decks for a number of passengers. The vessel is equipped with the latest and most improved appliances for the speedy handling of cargo. Immediately after being launched the *Hock Lee* was put under an electric crane at the builders' wharf to receive her machinery, which is of the compound surface condensing type and is being supplied by the builders.

Egerton.—On March 5th, there was launched at Leith by Messrs. John Cran & Co. a powerful steel tug for the Alexandra Towing Company, of Liverpool. The vessel will be fitted with powerful compound surface condensing engines by the builders, and was named the *Egerton* by Mrs. John Cran, Edinburgh.

Dredger.—On March 5th, there was launched at Renfrew by Messrs. Lobnitz & Co., Ltd., a hopper bucket dredger for the Suez Canal Company, which is the largest bucket dredger afloat. Her dimensions are: Length on deck, 305 ft; breadth, moulded, 47 ft.; depth moulded, 20 ft. 2 in., with poop and raised forecastle. The dredging depth is 15 metres, and the three-crank dredging engine is placed on the framing, direct geared to the top tumbler by machine-cut gearing of the most powerful description. The auxiliary gear is mainly hydraulic. Steam is generated by three large single-ended boilers. The vessel, which is being classed by Bureau Veritas, is fitted with steel deck, sheathed throughout with teak. Generally this dredger is similar to the large bucket dredger *Ptolémée*, recently supplied to the same owners by Messrs. Lobnitz and Co., Ltd.

Dolaura.—On March 5th, there was launched at Paisley by Messrs. Fleming & Ferguson, the twin-screw steam yacht *Dolaura*, which they have built to the order of the Hon. James Dunsmuir, Governor of British Columbia. The yacht is 238 ft. long, 32 ft. broad, and 22 ft. 9 in. deep, and has three decks, on the lower of which accommodation for guests is provided. The owner's quarters are situated on the main deck. On the shade deck is a large teak deck-house, in which accommodation is provided for the captain and officers, the fore-end being fitted out as a smoking-room. Special provision is made to ensure safety at sea. Watertight bulkheads and a complete watertight steel lower deck sub-divide the vessel into fourteen compartments, besides having a long mid-ship double bottom. The vessel has been constructed to Lloyd's A1 yacht class. Two sets of triple-expansion engines of 2,000 h.p. to give a speed of fourteen knots, will be supplied by the builders. The naming ceremony was performed by Mrs. D. M'Lean, Paisley.

Lady M'Callum.—On March 7th, there was launched at Dundee by the Caledon Shipbuilding and Engineering Co., Dundee, the twin-screw steamer, *Lady M'Callum*, which they have built for the British India Steam Navigation Co. The vessel, which is 230 ft. in length, 37 ft. in moulded breadth, and 13 ft. in depth, will carry a limited number of first and second-class passengers, who will be berthed in state-rooms amidships.

Lady Fraser.—On March 14th, there was launched by the Fairfield Shipbuilding and Engineering Co., Ltd., Govan, the twin-screw pilot cruiser, *Lady Fraser*, built for the service of the Indian Government. The vessel is 301 ft. 6 in. in length, 38 ft. in breadth, and 21 ft. in depth. She will have a speed of 12½ knots and will be fitted with three pole masts, specially high for signalling purposes and for carrying wireless telegraphy apparatus. A special feature will be the pilots' pinnace, placed on chocks between the main and mizzen masts. A most efficient arrangement has been made for the rapid handling of this boat, which has to be unshipped at sea with the pilots on board. Four steam winches are provided for this purpose. Under the forward end of the bridge deck there is a large and handsomely decorated saloon for the use of the pilots as a reading and smoking room, or as a dining saloon. There is also an elegantly furnished suite of state-rooms and ship's officers. The captain's cabin, combined with the bath room for the Government officials and rooms for the

chart-room, is under the bridge. For the pilots (twenty-six in number), accommodation is arranged on the lower deck forward, where two large dining tables with revolving chairs are fitted. The pilots are berthed in swinging cots, which are unshipped and stowed in racks when not in use. The leadmen's quarters, fitted up to accommodate ten persons, are on the lower deck immediately abaft the engine-room, and aft of this are the crew's quarters. The native crew, including deck hands, firemen, servants, etc., and numbering altogether about fifty, as well as the leadsmen, will sleep in hammocks, in spacious and well-ventilated quarters. The crew's wash-houses, etc., are located on the upper deck aft. The propelling machinery consists of two sets of triple-expansion surface-condensing engines, each set having three inverted cylinders working on three cranks. The high-pressure and intermediate-pressure cylinders are each fitted with a piston valve, and each low-pressure cylinder with a single-ported slide valve, all the valves being worked by the usual double eccentric and link motion valve gear. The crank shaft is in three pieces, each piece being built and interchangeable, and, like the thrust, tunnel and propeller shafts, is of forged mild steel. Each propeller has three bronze blades. The condensers are separate from the main engines, built of steel boiler plates and galvanised, the condensing water being supplied by two large centrifugal pumps, one for each condenser, each worked by an independent steam engine, and each capable of supplying circulating water to either condenser in the event of one pump being disabled. Both circulating pumps will be connected to large valves leading to the bilges, so that these pumps can if necessary be utilised for pumping out the engine-room. There are two boilers of the multitubular marine type, to work with natural draught, constructed entirely of steel and adapted for a working pressure of 200 lbs. The vessel was named and launched by Miss Burls, and after being floated was berthed in the firm's basin for fitting out.

Barcelona.—On March 18th, there was launched at Scotstoun by Messrs. Charles Connell & Co., Ltd., for Spanish owners, the steel screw steamer *Barcelona*, of about 5150 tons gross. She has been built for this company's special trade, with accommodation for sixty first, eighty second, and twenty-four third-class passengers, and also for 1000 emigrants. She is a sister ship to the *Cadiz*, launched by Messrs. Connell. The engines are being fitted by Messrs. David Rowan & Co., Glasgow.

Russia.—On March 19th, there was launched at Whiteinch by Messrs. Barclay, Curle & Co., Ltd., a twin-screw steamer called *Russia*, which they have built to the order of the Danish East Asiatic Co., Copenhagen. The vessel measures 493 ft. by 57 ft. 9 in. by 35 ft. 6 in., and has a gross tonnage of about 9000. Constructed to Lloyd's and Board of Trade passenger and emigration requirements, the *Russia* has accommodation for first-class passengers amidships on the bridge deck, the dining saloon being situated at the fore end of the bridge deck, with a large entrance hall immediately above, giving access to a combined music and smoke-room. The after part of the main deck and space under poop on upper deck provides accommodation for second-class passengers, with a comfortable dining saloon placed on the poop deck. The entire lower deck and also fore part of the main deck is fitted up for the carriage of emigrants, of whom the *Russia* will carry about 1500, the dining space and auxiliary departments being placed amidships under the bridge deck. The machinery, which has been constructed by the builders, consists of two sets of powerful triple-expansion surface-condensing engines, arranged to work on three cranks. They are supplied with steam from three double-ended and one single-ended boilers, with a working pressure of 200 lbs., developing power capable of driving the vessel at a speed of 16 knots. The christening ceremony was gracefully performed by Miss Winifred L. M. Maclean, daughter of one of the directors of Messrs. Barclay, Curle & Co., Ltd.

Messrs. S. T. Taylor & Sons have covered with their Tynos non-conducting material the boilers, pipes, etc. of the s.s. *Cundall* and donkey boil[illegible] of the s.s. *Dacre Castle*.

LAUNCHES Irish.

Rotterdam. On March 3rd, the launch of this vessel took place at Messrs. Harland & Wolff's shipyard at Belfast. The vessel's gross tonnage will be between 24,000 and 25,000 tons; she is 668 ft. long by 77½ feet beam, and has a displacement of nearly 40,000 tons. The launching weight was close on 14,000 tons, and she will be rigged with two masts and have two funnels, the horse power of the machinery being about 15,000. The *Rotterdam* will be fitted out in the most luxurious style. In fact, in some respects her appointments will be superior to anything yet afloat, as the vessel will have in addition to the other attractions—such as magnificent saloons, smoking rooms, library, writing rooms, passenger elevator, etc.—a large palm court. The machinery for the vessel has also been constructed by the same builders, and is of the quadruple-expansion balanced type, which from past experience has been proved to reduce vibration to a minimum.

Cochran (Annan) donkey boilers with patent seamless furnaces have been supplied to the yachts *Sagitta* and *Cascandra*.

TRIAL TRIPS.

Suruga.—Lately the steamer *Suruga*, built by Messrs. Archd. McMillan & Son, Ltd., Dumbarton, for the New York and Oriental Steamship Co., Ltd. (Messrs. Barber & Co., managers), ran trials on the Firth of Clyde. The vessel, which is of the long bridge type, is of 7,450 tons deadweight, having large hatches and clear holds, thus being specially adapted for the Eastern trade for which she is intended. The vessel is also fitted with two specially large derricks for dealing with heavy lifts and has a very powerful winch equipment. During the trial everything worked in the most satisfactory manner, a speed of 12 knots being obtained in spite of the stormy character of the weather. After the trial the vessel sailed for New York to load for the East.

Kamfjord.—On March 10th, the steamship *Kamfjord* (of which we gave particulars in our February issue, page 306), built by Messrs. Robert Thompson & Sons, Ltd., at their Southwick yard to the order of Messrs. Aktieselskabet Dampskibet "Kamfjord," Lars Christensen, Esq., manager, of Sandefjord, Norway, to take the highest class in Det Norske Veritas, was taken out to sea on her official trial. After a very successful one, Mr. Arnesen, on behalf of the owners, expressed himself highly satisfied with the vessel and smooth working of her machinery. The *Kamfjord* is supplied with a Cochran (Annan) donkey boiler with patent seamless furnace.

Cadiz.—On March 10th, the steamer *Cadiz* (of which we gave particulars in our March issue, page 348), built by Messrs. Connell & Co., Scotstoun, for Spanish owners, ran trials on the Clyde.

Darent.—Lately the screw tug *Darent*, built by Messrs. Ferguson Bros., Port Glasgow, went on her trials on the Clyde, attaining in six consecutive runs over the measured mile a mean speed of 11¾ knots, which is considerably in excess of contract requirements. The vessel has been built to the order of the Thames Conservancy Board, and will be employed in general harbour service, and also as tender to the dredging fleet. In equipment and design the tug is of the most modern description. The quarters for officers and crew are arranged aft of the machinery: under the bridge deck is a roomy charthouse; and forward of this is an excellent saloon panelled in polished oak. The propelling engines, which were constructed by the builders, are of the triple-expansion type, and steam is supplied by a large multitubular boiler having a working pressure of 180 lbs. per square in. Included in the auxiliary machinery is a powerful fire and salvage pump, with swivelling monitor on deck, while throughout the vessel is lighted with electricity. Fresh-water compartments are provided for supplying the dredgers, barges, etc., on the Thames.

Antares.—On March 17th, Messrs. Osbourne, Graham and Co. sent to sea for her official trial the steel screw steamer *Antares* (of which we gave particulars in our March issue, page 346), specially constructed by them for A. Kroger, Esq., of Christiania. Messrs. Geo. Clark, Ltd., have supplied machinery and boilers, and during the trial everything was satisfactory, a speed of 10¾ knots being easily attained. The vessel is supplied with a Cochran (Annan) donkey boiler with patent seamless furnace.

OBITUARIES.

Mr. Edward Elliott.—It is with deep regret we have to record the death of Mr. Edward Elliott, one of the superintending engineer's staff of the British India Steam Navigation Co., at Bombay, on March 5th, aged fifty years. Mr. Elliott was home on leave last year and underwent an operation at Glasgow in July. Feeling well and strong he left to resume duty in India, sailing in the *Chupra* for Bombay in December. Mr. Elliott was present with his brother Robert at the annual dinner of the Institute of Marine Engineers in October, and he also took part in the discussion on the paper "Repairs to Ships," read at the premises of the Institute on October 28th. Great sympathy is felt by a large circle of our readers for the widow and children; also for Mr. and Mrs. Robert Elliott, who are all resident at Greenock. Mrs. Elliott was looking forward to going out to India to rejoin her husband in the course of a few months, so that the shock of his death has thus been accentuated. Edward Elliott served his apprenticeship with Messrs. D. Rowan & Sons and Messrs. Chaplin & Co., both of Glasgow. After completing his apprenticeship he served about two years in the Clyde Shipping Co.'s steamers, then joined the service of the British India Steam Navigation Co. in August 1881, and was promoted through the various grades till he became chief engineer in February 1885. In March 1886, he was appointed Workshop Foreman at Mazagon, Bombay. Edward Elliott was much respected and esteemed by his colleagues and those who came in contact with him. The sad news of his death was transmitted by cable and received amid many expressions of sorrow and of sympathy.

Photo by F. [illegible] Lair, Bombay.

Edward Elliott, Bombay.
A Vice President of The Inst. Mar. Engrs., 1906-7

Photo by B. Barry, London, E.

Kenneth McInnes.
Member of The Inst. Mar. Engrs.

Mr. Kenneth McInnes.—We have received with great regret [illegible] that the illness which overtook Mr. Kenneth McInnes, the highly esteemed and popular chief engineer of the *Ormuz* during the last outward voyage, has resulted fatally [illegible] who is well known in musical circles. Mr. McInnes returned home in the *Ormuz* on March 8th in a feeble state of health, and died ten days afterwards at his house, Salisbury Road, Forest Gate, the funeral taking place on March 21st, at Little Ilford Cemetery, where a large number of engineering and other friends assembled to pay the last tribute of respect. Mr. McInnes was born at Kilbrandon, near Oban, in 1853; he served his apprenticeship with the Fairfield Engineering and Shipbuilding Co., and after some further experience on shore and at sea in the Russian Imperial yacht *Livadia*, built by the Fairfield Co., he joined the *Orient* as a junior engineer in 1880, after being promoted through the various grades to 2nd, he was in 1886 transferred to the *Ormuz*; about three years later he was appointed chief engineer of the *Orient* and subsequently was transferred to the *Ormuz*; he was thus in the service of the Orient Line for about twenty-eight years. He was elected a member of the Institute of Marine Engineers in 1890. His quiet, genial character, with the sterling qualities of his nature gained him the esteem of, and popularity among all associated with him. It is said that one has to sail with a man to know him, and those who sailed with Kenneth McInnes knew him for good.

PARAGRAPHS.

The Royal Naval Artificer Engineers' and Engine Room Artificers' Review contains articles of interest to all engineers while specially advocating the claims of those who serve King and country in the navy. It is somewhat difficult to follow the reasoning which has brought about a line of policy tending to reduce or to appear to reduce the artificers who have been termed the backbone of the engineering department of the navy. That the elevation of lead[illegible] to the responsible duty of watch keeping is looked upon [illegible] lowering of the artificer engineer is evident from articles and discussions on the subject, and the questions which have arisen from time to time in connection with the engineering department of the navy show, not only the

desirability, but the absolute necessity of strengthening the Board of Admiralty by a representative engineer. We advocated some years ago the appointment of Sir John Durston, the engineer-in-chief to the Board, and to-day it is even more desirable. The system of educating and training engineers for the navy introduced a few years ago does not appeal to the Mercantile Marine Engineer as calculated to produce the best men. It has narrowed down the area whence engineer officers can be drawn; the reverse policy would have been a wiser one, and more in accordance with the views of engineers who have considered the subject.

THE ORGANIZATION OF THE PERSONEL OF ENGINEERING WORKS.—A paper on this subject was read by Mr. M. Lang (Assoc. Member) before the Institute of Marine Engineers on March 2nd. The paper contains references to several improvements effected in most works equipped on modern lines. There are also hints and suggestions which commend themselves as making for the establishment of excellent relationships between employer and employed, while one or two of the suggestions appear somewhat impracticable, but with modifications might serve as groundwork to build upon. The tone of the paper is based on an ideal conception of things as they might exist rather than as they do exist. A savour of the elementary principles which evolved the idea of the Garden City pervades it, and in this respect the savour is sweet, but by contrasting the ideal with the real the taste becomes bitter to the palate. If the relations between capital and labour were in perfect harmony—a consummation to be heartily desired by all, in the interests alike of patriotism and brotherhood—then the union which gives strength to the whole would be complete and would add to the general prosperity of the country. The comfort and well being of every employé ought to be a consideration on the part of the employer, but no less should the progress and development of the employer's business be a consideration on the part of the employé. That the idea of the Garden City has been realized in great measure, shows that while the age is largely given to hard dealing and a considerable amount of selfishness, a leaven is not wanting to illustrate the better way of life and the best relationships of man with man. In the days of Abraham and Lot, there was strife between the employés of the one and those of the other, but it was very different, as far as can be judged, from the strife which is in evidence at the present day. The strife was for the best pasture, the policy evident on the part of Lot was backed up by the efforts of his men, as they probably recognised that the prosperity of their master would carry corresponding prosperity to them and their families by widening the area of operations. That this also applied to the men of Abraham seems clear from the conference which ensued and the arrangement made between the two employers. The greed of Lot was met by the magnanimity of his uncle, and in the sequel the choice of the former proved to be a most unwise one. In principle history has repeated itself, and the unwisdom of Lot has been illustrated with frequency during the years that have passed since his day, bringing trouble upon succeeding generations. One very deplorable feature of present-day labour is the utter blindness of many quondam leaders who rave at employers and at all capitalists, as if they were public enemies. Others, again, strive to reduce the productive power of their fellow-workmen to their own mediocrity with groans and threats, a despicable resort. If every man sought to do his best and did it, employers and employés pulling all together, increasing the output and reducing the cost, the development and wider area over which the resulting product could be spread would bring more work and the employment of a larger number of men. The luxuries of one age tend to become the necessities of the next, thus adding to the cost of living, a cost which is largely met by a reduction in the cost of transit and of production, assisted by an increase in wages. The cost of transit by sea has been considerably reduced, the cost of production in several directions has also been reduced, and there is not the slightest doubt that if every man did his duty in faithfulness and diligence there would be less discord, more comfort and a considerable increase in the happiness of the people.

CONGRESS ON NAVIGATION.—Arrangements are being made for a conference on navigation, to be held at St. Petersburg, extending from May 18th to June 7th. Those who can take advantage of the opportunity afforded of attending the conference will find a very attractive programme awaiting them, and we have pleasure in calling attention to the circular we have received on the subject, giving a warm welcome to all who are interested in the various questions which are to be discussed and the places to be visited. We quote from page 5 of the circular for the information of our readers. "The conditions of admission to the Congress for all persons, whether private individuals or representatives of institutions, societies or companies that are not permanent members of the International Association of Congresses, are the following: These persons should send in their names as temporary members of the Association by filling in the annexed declaration and sending it as soon as possible, accompanied by their member's subscription of twenty-five francs for each person, whether private individual or representative of institutions, societies or companies, addressed to the General Secretary of the 11th Congress, 7 Ismailowsky Prospect, St. Petersburg. Those that are thus inscribed as temporary members have the right of being present at all the public sittings of the Congress, as well as at those of the sections, at the receptions and festivals, and, on payment of an extra charge, of taking part in the excursions, the programme and conditions of which will be duly forwarded to those that have sent in their names. They shall also receive all the communications of the organizing committee before the opening of the Congress, the bulletins of the Congress, the reports and communications, the accounts of the sittings and other publications of the Congress; they shall also have the privilege of special fares by rail or boat, if the reductions asked for by the organizing committee be granted, of which fact all the inscribed members will be duly informed. The organizing committee of the 11th Congress on its part will do everything possible to insure the success of the Congress; it will consider it its duty besides to afford every help and assistance to all the members, if they should desire to undertake a journey in Russia after the Congress. On this account, the committee begs the permanent members of the Association, as well as those persons that desire to become temporary members, to send in their applications immediately, so as to admit of all the necessary measures being taken in time." The chief subjects to be discussed are: I. Inland Navigation, Constructural Work. II., Maritime Navigation. Constructional work. In connection with these sub-divisions there will be an exhibition of models, plans, maps, etc. to illustrate the different ideas. Excursions during the Congress are to be made to Peterhof, the Neva, Lake Ladoga, The Canals, the Lighthouse of the Lake, the harbours of St. Peterburg and Cronstadt, the waterfalls of the Narova and the hydraulic works, the Cataracts of Imatra. After the Congress, there are two excursions proposed: the Volga down to Nishni-Novgorod and Moscow, and the harbours of the Baltic Sea. In addition to these there are more extended journeys planned, but we have indicated sufficient to show that the programme is both interesting and instructive, besides affording an opportunity of coming into touch with possible customers and getting into close contact with their requirements and necessities. In days when trade is on the wane, the spirit of enterprise ought to be abroad, to seek what can be picked up in fresh fields.

BOARD OF TRADE EXAMINATIONS.

1908. Extra First Class.

Jan. 25th	—Cachia, Vincent ..	Ex 1C London
,, 25th	—Cheesewright, S. E. ..	Ex 1C London
,, 25th	—Crangle, Francis ..	Ex 1C London
Feb. 1st	—Denton, Ernest	Ex 1C Liverpool
Jan. 25th	—Duncan, John H ..	Ex 1C Glasgow
,, 25th	—Dilworth Harrison, D. R.	Ex 1C N Shields
,, 25th	—Finch Thomas N ..	Ex 1C N Shields
,, 25th	—Gordon, William F. ..	Ex 1C W Hart'l
,, 25th	—Hamilton George ..	Ex 1C Belfast
Feb. 1st	—Hayes, John	Ex 1C Liverpool
,, 1st	—Huntley Reginald ..	Ex 1C Hull
Jan. 25th	—Isaac Gilbert J	Ex 1C Bristol
,, 25th	—Leet, Lewis	Ex 1C London
Feb. 1st	—Mackay, John S. ..	Ex 1C Liverpool
Jan. 25th	—M'Gibbon, James E ..	Ex 1C London
,, 25th	—M'Leod Robert J ..	Ex 1C N Shields
,, 25th	—Nicol, James M.	Ex 1C London
,, 25th	—Paynter, Richard H. ..	Ex 1C London

Board of Trade Examinations—*continued.*

Feb. 1st—Sherritt, Thomas D. .. Ex 1C Glasgow
Jan 25th—Taylor, Benjamin .. Ex 1C N Shields
,, 25th—Thomson, John .. .. Ex 1C London
,, 25th—Trechmann, Otto J. .. Ex 1C W.Hart'l
Feb 1st—Wales, Ernest R. .. Ex 1C Hull
,, 1st—Wells, Frank .. .. Ex 1C Liverpool
Jan 25th—Wright, Lawrence W .. Ex 1C N Shields

NOTE—1C denotes First Class; 2C Second Class.

January 25th, 1908.

Armes, James .. 1C London
Armstrong, A S. 2C W. Hart'l
Baldry, Albert 2C W. Hart'l
Berry, James .. 2C Glasgow
Bowles Percy.. 2C London
Buchanan, Arch. 2C Barrow
Carter, Samuel 2C N Shields
Christie W. P. 1C Leith
Cousins, Walter 1C W. Hart'l
Cozens, Jas. W. 2C Liverpool
Currell, John .. 2C Barrow
Devonald, O. E. 2C Cardiff
Faulds, Robt. A. 1C Glasgow
Ferguson, John 2C Glasgow
Fleming, F E. 2C Liverpool
Foster, H. T. .. 1C W Hart'l
Hamley, L. C. 1C Plymouth
Herriot, Walter 2C Liverpool
Howie, Robert 1C Glasgow
Kelly, John J... 2C Liverpool
Kemp, Robert.. 2C South'ton
Larmour, E.A R 1C South'ton
MacIntyre, H D 2C Glasgow
Magahy, James 2C Barrow
Maher, J. P J. 2C London
M'Callum, Neil 1C Glasgow
M'Mordie S .. 2C South'ton
Rees, Allen .... 1C London
Simpson, Thos. 2C Leith
Smith, Leslie H 1C London
Thompson, E C. 2C Plymouth
Thompson, W 2C N Shields
Thompson, G H. 2C Leith
Williams, E T 2C Cardiff
Wilson, B. A. B. 1C South'ton
Wilson, Jas H 2C Leith
Woodhead, F B 2C Liverpool

February 1st.

Anderson, Jas 2C Aberdeen
Angus, William 2C Aberdeen
Alder, Walter 2C Sunderl'd
Ayers, Allan .. 1C Sunderl'd
Barker, C H .. 1C Hull
Boyd, R V .. 1C London
Brackenbury, A 1C Hull
Carrol, Alex .. 2C Aberdeen
Corfield, A E . 2C Liverpool
Creed, Henry F 1C London
Donald, Peter.. 1C Greenock
Ellis, Reg. M 2C Liverpool
Ferry, Ernest S 2C Sunderl'd
Forrest, H R 2C London
Frearson, Geo 1C London
Gibb, Charles.. 2C Aberdeen
Glassey, James 2C Aberdeen
Grant, Alex H 1C Aberdeen
Green, Alex H 1C Aberdeen
Hale, Jos M 1C Liverpool
Halliday, G C 2C Hull
Harrison, C E 2C Sunderl'd
Harrison, J. S 1C Hull
Ingleton, John 1C Liverpool
Johnson, J G 2C Sunderl'd
Jones, Edwin K 2C Bristol
Kennington, P 1C Liverpool
Kirkwood, J T 2C N Shields
Kern, Henry F 1C N Shields
M'Connel, W.E. 2C Liverpool
Neill, Ernest R. 2C Aberdeen
Orritt, Stanley 2C Liverpool
Owen, Herbt. J 2C Liverpool
Parsons, Bertie 1C London
Pirie, Alex. D 2C N Shields
Proud, Robert 2C N Shields
Roberts, W. H. 2C Liverpool
Russell, Alex... 2C Greenock
Smith, Frank .. 2C Liverpool
Smith, James L 2C N.Shields
Smith, John W. 1C N Shields
Stirling, Robt. 1C Greenock
Thomas, R J... 2C Liverpool
Taylor, John L. 1C Liverpool
Watson, E. G. 1C Liverpool

February 8th

Barnes, A M... 2C London
Barnes, Wm. F. 1C London
Barlow, George 2C N Shields
Bartlett, Wm. B 2C Liverpool
Bell, Edward S. 2C N.Shields
Bishop, Robt.A 2C South'ton
Bricknell, Edgar 2C Cardiff
Brown, Thomas 1C Glasgow
Cameron, A G. 1C N Shields
Clark, S. F. .. 2C Liverpool
Corliss, Cyril E 2C Liverpool
Couch, S. G .. 2C Liverpool
Cowper, David 2C N.Shields
Ellison, Joseph 1C N Shields
Esdon, Henry 2C N Shields
Evans, W. A. C 1C Cardiff
Govan, F. M'K 2C Belfast
Hammond, E 2C South'ton
Harvey, F R 2C South'ton
Heatley, Thos. 2C N Shields
Hoare, Robt. E 2C Cardiff
Howie, Wm. A 2C Glasgow
Humphrey, Tom 2C London
Jelley, O H .. 2C Cardiff
Kitching, Fred 2C N Shields
Leathem, Fred 2C Belfast
Legg, Francis A 1C South'ton
Lumb, Geo F 2C Glasgow
Maciver, D K 2C Liverpool
Macneish, P. N 2C South'ton
M'Auley, Arch. 2C Leith
M'Culloch, D. 1C Glasgow
M'Dernott, H. 1C Belfast
M'Kinley, Isaac 2C Belfast
M Lean, Arch 1C Glasgow
Morgan, Arch C 1C Glasgow
Morgan, T F 1C Liverpool
Morrison, Hugh 1C Glasgow
Mortleman, G 2C London
Nesbitt, Robert 2C Glasgow
Nickson, Arthur 2C Liverpool
Parker, Victor 2C N Shields
Potts, J. W. A 1C South'ton
Prentice, C S 2C Glasgow
Rees, David J 2C Cardiff
Roscoe, Peter.. 2C Liverpool
Smith, John. .. 2C Leith
Stagg, Albert E 1C N Shields
Stephens, G .. 1C Liverpool
Stothard, Thos 2C N Shields
Summers, G S 1C Glasgow
Sutherland, J F 2C London
Timney, N C. 1C Cardiff
Tregeagle, R H 2C Cardiff
Wakem, Harold 2C Liverpool
Weller, H. J. .. 2C London
Wetton, H. E. 2C N.Shields
Wilson, James 1C London
Wilson, William 2C Glasgow
Wilton, T K .. 2C N Shields

February 15th.

Armstrong, R. 2C N Shields
Bennett, A E. 2C N.Shields
Clarke, John R. 2C Liverpool
Crawford, W. C. 2C Greenock
Foulkes, Jas E. 2C Liverpool
Honey, H. W. 1C Liverpool
Kennedy, David 2C Greenock
Kerr, William 1C Greenock
Lawrence, A J.L. 1C London
Lowe, S. E .. 1C Liverpool
Marwood, F S 1C London
M'Lean, Duncan 2C London
Morton, Wm .. 2C Dundee
Mountain, W. J. 2C London
Nairn, R C. S 2C Greenock
Palmer, F. B .. 2C Hull
Parry, Chas M 1C Liverpool
Poole, Arthur H. 2C N Shields
Renton, Alf N. 2C N Shields
Roberts, Arthur 1C London
Russell, D R 1C Liverpool
Smith, Thos. C 2C Dundee
Walker, Jos. L. 2C Liverpool
Webber, D .... 2C Hull
Whitfield, H... 2C N.Shields
Youngson, W... 1C N Shields

February 22nd.

Allan, Robert .. 2C Glasgow
Baillie, John .. 2C London
Banks, Thos K. 1C W Hart'l
Barkley, W F. 2C Liverpool
Barnes, Jas. E. 2C Liverpool
Baxter, J G. B 1C Barrow
Bell, Wm. A... 2C N.Shields
Benzie, Geo. G 2C Glasgow
Bird, John E. 1C W Hart'l
Blair, James .. 1C N.Shields
Broughton, E. 2C W Hart'l
Brown, John M 1C Glasgow
Burnett, J .... 1C W. Hart'l
Clements, C H 2C Liverpool
Collingwood, E 2C South'ton
Cook, John R 2C N Shields
Cummins, V .. 2C W. Hart'l
Curr, Thomas 2C South'ton
Davies, Hendrie 1C Cardiff
Davies, Sidney 1C Cardiff
Day, Chas H 1C London
Evans, Wm S. 1C Cardiff
Fairnie, Wm .. 1C Glasgow
Fisher, Alfred.. 2C W Hart'l
Forster, H C 1C W Hart'l
Fyall, E W .. 2C N Shields
Gibbs, Watson 2C N Shields
Gillhespie, H E 1C N Shields
Gill, Arnold R. 1C N Shields
Gunn, John .... 1C Glasgow
Hadden, R S .. 2C Leith
Harrowar, H .. 2C Glasgow
Hornby, W R 2C Liverpool
Hornsey T H 1C W Hart'l
Jackson, Alex 2C Glasgow
Jenkins, Lewis 2C Cardiff
Jolly Robert A 2C Leith
Kinread, I R 2C Liverpool
Lidgett, Geo D 2C N Shields
Land, W A C 2C Glasgow
Livingston, John 2C Glasgow
Mann, William 1C Glasgow
Martin, John .. 2C Liverpool
Maughan C F 1C W Hart'l
Maybray, W .. 1C W. Hart'l
M'Cormick, R. 2C Glasgow
Miller, Robt. S 1C Glasgow
Milliken, George 1C Glasgow
Mitchell, A. J 2C Glasgow
M'Kay, William 1C Liverpool
Morris, Thos. O. 2C Liverpool
Murphy, Wm. 1C N Shields
Oag, James .... 1C London
Pickles, Geo. A 1C W. Hart'l
Pringle, J. J R. 1C Liverpool
O'Donovan, J 2C Glasgow
Rainey, John T 1C Barrow
Robertson, D... 2C Glasgow
Rodgers, J.L.W. 1C W. Hart'l
Rose, Matthew 2C Glasgow
Small, William 2C Leith
Snoswell, Bert. 2C London
Spence, John T. 1C Liverpool
Stephen, T M'C 1C South'ton
Stewart, John.. 2C Glasgow
Thomas, Tom.. 2C Cardiff
Tornquist, Jas. 1C W. Hart'l
Walsh, James C. 1C Liverpool
Wardle, James 2C N.Shields
Warren, A H. 2C Liverpool
Watson, W. R. 2C W. Hart'l
Webster, C. E. 2C London
Williams, Thos. 2C Cardiff
Wilson, D L .. 2C Liverpool
Wilson, John .. 2C Leith
Wilson, John R. 2C W. Hart'l

February 29th

Angus, W. J. T. 2C Aberdeen
Band, Wm. W 1C Sunderl'd
Barron, Garratt 1C Hull
Butter, Jas M. 1C London
Cable, Fredk C 2C London
Cawthron, F .. 1C Hull
Clark, Pierce F. 2C Liverpool
Cooper, Jos. H 2C Bristol
Costigan, Rich. 2C N.Shields
Coutts, William 1C Aberdeen
Cove, William 2C Greenock
Cumming, G. K. 1C Aberdeen
Dadswell, Edwin 2C London
Davies, Sam. R. 2C London
Field, Owen G. 2C Bristol
Frederick, F. J 1C N Shields
Galloway, Chas. 2C Greenock
Hawkins, J. R. 1C Bristol
Hedgworth, C. 2C N.Shields
Holt, Stephen.. 2C Liverpool
Johnson, Wm 2C N.Shields
Johnston, Wm. 2C Aberdeen
Jones, John S. 1C Liverpool
Kemp, Geo. A. 1C Aberdeen
Lamb, Robert.. 1C N Shields
Lawie, James E 1C Aberdeen
Lawrance, C. H 1C Aberdeen
Liston, William 2C Liverpool
MacInnes, A M 1C Greenock
Malcolm, Alfred 1C Liverpool
Martin, Alf. R. 2C London
McFaddin, W. 1C Bristol
Mitchell, E. P 2C Hull
Murphy, Wm. 2C Sunderl'd
Rutherford, E.P. 2C Liverpool
Shanklin, O B. 1C Liverpool
Simpson, Edw. 2C Aberdeen
Sowerby, C .. 2C N.Shields
Squires, S. J. F. 2C London
Stewart, Siddell 1C Greenock
Symington, W 1C Greenock
Tattersall, H... 2C Liverpool
Taylor, William 1C Greenock
Tweedlie, A. S. 2C Greenock
Venables, G. E. 1C Liverpool
Wilcock, Joseph 1C Liverpool
Wood, John H 2C Bristol
Wylie, Sid W. 2C Liverpool

The Marine Engineer

And Naval Architect.

LONDON, MAY 1, 1908.

MODERN ARMOUR AND ITS ATTACK

AN extremely interesting contribution by Captain T. J. Tresidder was read before the last session of the Institution of Naval Architects upon the attack by capped projectiles, shells by preference, upon the modern armour. First, with regard to old reports upon armour-plate trials, the term of "no penetration" is objected to, as this term can only mean "no perforation," as the fact that for a projectile of any lightness there must always be some penetration to make up a reacting resistance to the projectile. The power of the blow struck by a projectile may be represented by the expression Wv^2 and this can be only nullified by the reaction of the plate in the form F.S. where F is the mean pressure of the reaction of the plate upon the projectile, and this must be multiplied by the distance S, which can only be obtained by penetration. If this penetration does not strain the material of a plate beyond its elastic limit, it will be temporary only. It may leave no trace, but if there has been a collision of any kind it will have occurred all the same. Penetration is incomplete perforation, whilst perforation is complete penetration. The resistance of armour plates to projectiles may be divided into three classes: (a) rigid and concentrated, (b) yielding and distributed, or (c) a combination of (a) and (b). Steel plates that are hard throughout are examples of the (a) class, whilst plates that are tough throughout are examples of the class (b). The modern face-hardened plates would come under class (c). It was owing to the power of hard-faced plates to break up the points of projectiles that caused these plates to be introduced. The use of capped projectiles has caused their power of penetration to be largely increased. Without such a frontal cap the shell is broken by a small piece in the form of a double-ended cone being driven back by the impact into the head, and splits it like a wedge. This initial split is followed by numerous others, following each other in the pointed end of the projectile, which break up and fly tangentially to the plate as fast as they form, so that the rear part of the shell is piled up on the front part. It was to deal with this bursting of the front part of the shell that caps were introduced. Why was a sharp point ever given to a projectile? To concentrate compression stress and to give it high intensity in the hope that the plate would yield thereto before the projectile did. This hope was realized when plates were soft and homogeneous. Then came the steel faced compound plate, which put up the standard of stress intensity to more than the chilled cast-iron projectile could stand. The reply was the forged steel shell, which brought victory once more to the side of the attack. The defence retorted with the all-steel plate, with super carburized and chilled face, raising stress intensity again to a point at which the shell was the first to give way. Now the projectile gives battle with its nose swathed in a steel bandage to increase its power of bearing stress intensity, and this expedient, for the time at least, has restored its supremacy. The cap added is of such a nature as will give support to the point of the shell. It is first compressed by a suitable hydraulic pressure until the surface of the cap is practically level with the point of the shell, the diameter being less than the diameter of the shell.

THE CUNARD TURBINE STEAMER "LUSITANIA"

MR. THOMAS BELL read before the Institution of Naval Architects at their last session a paper "On speed trials and service performance of the Cunard turbine steamer *Lusitania*." This subject is a little after the date of the first trials and the first ocean voyages of the *Lusitania*, during July and August of last year, but there is much added information in the tables submitted with this paper, with the full designs as given of the engine and boiler accommodation of the vessel. In detailing the engines of this vessel it is pointed out that the main engines consisted of two pairs of compounded turbine engines on four shafts, with two astern turbines which are placed upon the two central shafts. The boilers, it will be remembered, are divided into four equal groups in separate water-tight compartments. Then follow full details of the principal dimensions of the turbines, condensers and boilers. With regard to the running of this large machinery and boiler installation, it must be remembered that lubrication was a forced system for these engines, and also there was a system of feed-water heating of the supply to the boilers, full particulars of which are given. The lubricating oil was admitted to a large main reservoir tank through which sea-water pipes were run to keep down the temperature of the oil to 30° above that of the engine-room. Six oil pumps were supplied to deal with this oil, of which four were only kept in constant use. The effect upon the steam supply is noted as being an obvious loss of percentage when the fires had to be attended to and cleaned in the ordinary manner. The main steam trials on July 27th are duly noted, with the pleasure trip, when consumption trials at 18, 21 and 23 knots were carried out. Stopping and circle trials were afterwards carried out and eventually the ship was passed for her first ocean voyage outwards. We have already had the speed run on that first voyage recorded as amounting only to a speed of 24·05 knots per hour, but this was due to a furious gale, which reached its height during the

last twenty-four hours, bringing, during its height, the speed down to below 23 knots an hour. The excellent tables with which this paper concludes are well worth the attention of readers.

SUPERHEATED STEAM IN MARINE ENGINES.

IT has been said by Mons. Felix F. T. Godard that superheated steam was used in marine engines half a century ago, in his paper upon this subject, read before the Institution of Naval Architects, though the particulars as to these very early trials have not been elucidated. But, as is now generally well known, the employment of superheated steam for engines of any kind has been neglected for many years, and has only been brought before us for the last ten or fifteen years. The author's experiment began a few years ago, when he made experiments on a triple-expansion engine of about 300 H.P., fitted with piston valves. His experiments here were successful, showing by his records a saving of 35 to 32 per cent. He instances two pairs of ships built in France, which are interesting, the first pair were built alike of 2700 tons, the one built to use saturated steam and the other to use superheated steam. The vessels were named the *Garonne* with saturated steam and the *Rance* with superheat. After their trial they were put into service immediately, and we are given the figures resulting from ten trips. The figures are that with the *Rance* there was an economy of 18·2 per cent., and there was no trouble with either engines or boilers. The other ships mentioned are the *Péron* and the *Guadeloupe* cargo vessels, having gross tonnage amounting to 6800 tons. Each vessel was fitted with twin-screw triple-expansion three-cylinder engines, and six cylindrical boilers with three furnaces, each fitted with Howden's forced draught. The steamer *Péron* has only just finished her trials, but she has gained 0·35 knots by the use of the superheating.

THE HEATING OF OCEAN LINERS

THIS is hardly a heading for the Institution of Naval Architects, but a paper on this subject has been received by them, read by Mr. W. Carlile Wallace. Although we have generally given consideration to the subject of heating and ventilation to our own passenger steamers, it is in the American Line of Atlantic passenger steamers that the subject has been well thought out, the air being heated by steam pipes; but though satisfactory as regards ventilation, it was found impossible to regulate the heat in the state-rooms with any degree of certainty. In the *Lusitania* and the *Mauretania* a system of thorough ventilation and heating by electric wire has been provided, which is thoroughly satisfactory except for the high cost of carrying the system out. A system recommended by Mr. Wallace is one similar to that fitted on the *Lusitania* and *Mauretania*, supplemented by a system of individual electrical heating, the whole combination being under automatic control. Dr. Geissenger, surgeon of the s.s. *St. Paul*, is credited with the invention of an accurate thermostat for this purpose, with a difference of 4°F. for day and night, the day temperature being at, say, 68°F. The Superintendent Engineer of the s.s. *Oceanic*, of the White Star Line, has carefully given the figures of the current used in heating this vessel, where the control of the appliances is directly in the hands of the passenger. Thus, by comparing the calculated kilowatts taken directly from the *St. Paul*, to check the actual figures used in the *Oceanic*, the result is a loss in kilowatts per room of 58·9 to 86·7 k.w. for the voyage west and east, which results in a total loss of kilowatts of 2,827 to 4,340 k.w. for the respective journeys. Now, if we can, by the system and control used on the s.s. *St. Paul*, make a saving of over 7,000 k.w. for the two journeys to America and back, this would seem worth doing, for the automatic control is worth something, as it gives a uniform temperature.

THE ASSOCIATION OF ENGINEERS-IN-CHARGE.—The thirteenth annual dinner was held in the King's Hall, Holborn Restaurant, on March 28th, when the company numbered about 300. W. H. Patchell, Esq., the president, presided, and was well supported on both sides. After the Royal toasts, that of the Association was submitted by Mr. W. P. Boulnois, who urged careful attention to the duties of the day. A high ideal of duty was a treasure itself, and in aiming at such an ideal there was more satisfaction than in the mere gaining of money; while the influence of those who sought to place duty in the first place had far-reaching effects on the nation itself—made up as it was of an aggregate of units. Mr. Alex. Ritchie, J.P., responded, and referred to the self-denying labours of Mr. H. Capsey (hon. sec.), and Mr. Arthur Davey, who was in the vice-chair, to them, thanks of the association were due for unremitting attention to their duties. Good machinery required careful attention, and to be kept up to its work to give the highest efficiency, and this was opposed to the bad policy of driving as near to the verge as possible; the better plan was to keep far away from possible breakdown by maintaining and supervising—exercising forethought to avert disaster. The object of the association was to keep up the standard and give opportunity to discuss details of work with exchange of experiences for mutual advantage. The President proposed the toast of "Our Guests," carrying a vein of humour throughout his speech, he pointed to the different nationalities represented, the English, the Irish and the Scottish, each bringing its own characteristic to help in building up the Empire. He coupled the toast with the name of his Honour Judge Rentoul, whose delightful Irish humour kept the company in great spirits. Humour there was and good hits, but no less was there much to think about in the references to expert witnesses, to the component parts of Britain, and to the United nationality showing a steady front to all comers. Mr. Arthur Davey proposed the health of the President, who in responding said he was pleased to note that his year of office was a record of increased membership and of progress in many ways. He proposed that a library should be founded, and all were desired to contribute. Mr. W. B. Hatch proposed "Kindred Societies" which was responded to by Mr. E. B. Ellington (vice president Institute of Mechanical Engineers), who, in his reply emphasized the need for developing and catering for the social as well as the technical side. The social was of great use in helping forward the technical. During the evening Mr. G. Hardy's "Bijou Orchestra" played selections, while several songs were sung between the speeches; the programme was concluded in the usual loyal way, thus ending a very successful gathering.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE spring meeting of the forty-ninth session of the Institution of Naval Architects was held in the hall of the Society of Arts, John Street, Adelphi, on Wednesday, April 8th, and two following days. The president, the Right Hon. the Earl of Glasgow, G.C.M.G., occupied the chair and there was a large attendance of members, amongst whom we noticed Lord Pirrie, Sir John Dalrymple Hay, Sir John Thornycroft, Sir Digby Morant, Sir Philip Watts, the Hon. C. A. Parsons, Prof. J. H. Biles, Prof. J. J. Welch, Admiral Fitzgerald, Dr. Elgar, Dr. John Inglis, Captain Tucker, Messrs. Whiting, W. E. Smith, Cornish, Thearle J. Foster-King, John Gravell, G. R. Brace, James Dunn, James M'Kechnie, Sidney Barnaby J. E. Thornycroft, Pratton, Andrew Laing, R. J. Walker, A. E. Seaton, J. Hamilton Gibson, C. E. Stromeyer, Saxton White, J. Silley, A. F. Yarrow, John Ward, C. E. Ellis, James M. Dewar, Holzapfel, D. G. Dunlop, May, Bertin, Leslie Denny, Andrew MacLean, and Sir George Holmes (late secretary of the Institution.)

The proceedings were opened by the president calling upon the secretary to read the Annual Report.

Annual Report of the Council for 1908.

The Council have pleasure in submitting their annual report upon the progress made during the past year. The total number of new candidates elected during that period was 137; but, owing chiefly to the numerous losses by death, the net gain in membership is reduced to 38, the actual numbers on the books being 1,796.

The Treasurer's report shows a satisfactory financial statement for the past year.

The Council have received with regret the resignation of the Earl of Glasgow, G.C.M.G., from the office of president, which he has occupied with so much distinction and advantage to the Institution since 1901. The Council desire to express their cordial thanks to Lord Glasgow for his services during his period of office, and their high appreciation of the courtesy and tact which his lordship has invariably displayed while presiding over the meetings of the Council and of the Institution.

A Summer Meeting was held at Bordeaux last June jointly with the French, German and American Societies of Naval Architects. The meeting constituted an International Congress of Naval Architecture, under the joint presidency of Lord Glasgow and Monsieur Bertin, and was attended by delegates from the principal maritime countries. Owing to the large number of papers contributed, it was only found possible to include in the Transactions of each Institution those papers which were read by its own members. The reception accorded by the local authorities and the influential residents was most cordial, and the Maritime Exhibition, with its valuable collection of British ship models, formed an interesting feature of the meeting. Visits were paid to the various shipbuilding and engineering works in the neighbourhood, notably to the Chantiers de la Gironde, Messrs. Dyle & Bacalan, and also to the famous vineyards of Château Margaux. Mention must also be made of the subsequent journey by special train to the great steel and armour plate works of Messrs. Schneider & Co., at Le Creusot, where a thorough inspection of the works was made, and a most hospitable welcome was accorded to those members of the Congress who were able to make the trip.

The Council have, under Rule XI., elected as Honorary Vice-presidents Dr. F. Elgar, F.R.S., treasurer of the Institution, and Mr. James Dixon, chairman of Lloyd's Register Society.

The Institution of Naval Architects Scholarship, which was competed for last year, has been awarded to Mr. A. M. Robb, of Messrs. G. L. Watson & Co., Glasgow, on the result of the examinations held by the Board of Education in the prescribed subjects, and the successful candidate is now pursuing his studies at Glasgow University.

The Council have received from Mr. A. F. Yarrow, Vice-president, an offer to defray the cost (up to £20,000) of an experimental tank for research purposes to be erected at the National Physical Laboratory, Bushy, provided the expenses of maintenance for the first ten years are assured; and suggesting that the shipbuilders and shipowners of the country should be invited to guarantee the necessary amount for that purpose. Mr. Yarrow's munificent offer has been gratefully accepted subject to the conditions under which it is made, and a committee will be formed in order to take such steps as may be necessary to carry the scheme to a successful issue.

The losses through death during the past year have unfortunately been numerous. The Marquis of Linlithgow, who, as Lord Hopetoun, will always be remembered with esteem and affection by the Council and members of the Institution, passed away last month at the early age of forty-five. As president from 1896 to 1900, Lord Linlithgow contributed largely to the success of the Institution during a period of particular interest in its history, and his death in the prime of life is one that has caused widespread sorrow among all those whose privilege it has been to appreciate his lordship's great natural gifts for high office, and the charm of manner which was one of his unfailing characteristics. Lord Kelvin, an honorary member of this Institution of over thirty years' standing, passed away at the close of last year, mourned by the entire scientific world. The Council also regret to record the death of Mr. J. McFarlane Gray, Vice-president, many of whose valuable contributions to the elucidation of problems in Naval Architecture and Marine Engineering have appeared in the Transactions; of Mr. Robert Thompson, of Sunderland, and Col. H. F. Swan, C.B., of Newcastle-on-Tyne, members of the Council; and Mr. C. H. Haswell, the oldest and one of the most respected of the marine engineers in the United States.

Among the Associates the Institution has lost Sir William Pearce, Bart., late chairman of the Fairfield Shipbuilding and Engineering Company, Sir J. D. Milburn, Bart., and Major-General Sir John Crease, K.C.B., while the death of Mr. John Corry, honorary Vice-president, has deprived the Council of an old and valued colleague.

The Council have pleasure in announcing that they have awarded an Institution Premium to Mr. Lyonel Clark for his paper on "Modern Floating Docks;" and another to Mr. J. Hamilton Gibson for his paper on "Torque of Propeller Shafting: Some Investigations and Results."

The president having moved the adoption of the report, which was carried *nem. con.*, the list of names of proposed new members, associate members and associates was read by the secretary, and scrutineers appointed to examine the papers.

President's Address, 1908.

Gentlemen, in the annual report of the Council you have heard a very satisfactory account of our work during the past year, and I am happy to be able at the opening of this our forty-ninth session, to congratulate the members of the Institution upon its flourishing condition from every point of view. The accession of new members continues to strengthen our ranks, especially on the professional side, notwithstanding the more difficult conditions of entry, and I am pleased to announce that the list of new candidates that have just been elected is the largest yet dealt with at any spring meeting of the Institution. This is the more satisfactory as the last two decades have seen the birth and growth of a number of societies in France, Germany, the United States and elsewhere on identical lines with our own, while the allied institutions at home continue to flourish and supply the needs of local centres where interchange of ideas and discussions on topics of professional interest can be carried on during the major portion of the year. Our Institution is peculiar in that so large a proportion of its members being resident either in the outports or abroad, it would be difficult to bring them together otherwise than is now done, at the annual gatherings in London, and at the occasional summer meetings which have formed a distinctive feature of our sessions for many years past.

Our meeting at Bordeaux last year has already been alluded to in the annual report, but I should like to emphasize our appreciation of the cordiality of our reception there and at Le Creusot, a feeling which was generally expressed on all sides by those who attended the meetings and the subsequent visits. The forthcoming Franco-British Exhibition in London will, I hope, further cement the bonds of friendship already existing between the two nations, and give some of our great engineering firms an opportunity of reciprocating the welcome

and showing our friends from across the Channel and elsewhere the products of their skill and enterprise.

That the past year has not been one of continuous expansion in the shipbuilding and marine engineering trades is now a matter of history. Indeed, a reaction from the exceptional activity of the previous few years had been foreseen and predicted by those best acquainted with the prevailing conditions. To those who follow year by year the progress of these industries it must be obvious that the laws of supply and demand are as inexorable as ever in governing the fluctuations of trade. Years of high freights and low prices of materials create an abundance of shipbuilding orders which go to swell the output of the following year or two, but an inevitable reaction follows when the demand for freight carriers slacks off and the completion of orders on hand leaves building slips empty and shops running half time. But in addition to the causes operating in, so to speak, a normal manner, there came last year very suddenly, though not perhaps entirely unexpectedly, the financial panic in the United States, which entailed an awkward period of stringent money and high rates and caused much uneasiness throughout the financial circles of the world. This naturally had its immediate effect upon trade generally, and the shipbuilding and engineering interests suffered with the rest. Then, labour troubles inevitably follow closely in the wake of contraction of business. The workmen, willing enough to take advantage of the flood-tide of prosperity, find it difficult to realize that the ebb has also to be reckoned with, and often refuse to accept the inevitable reduction in wages that must take place if work is to be carried on during slack times. It was recently stated that, apart from obsolete and new berths, over 50 per cent. of the shipbuilding berths on the North-East Coast were vacant, and the outlook at that time was extremely unpromising. Since then the strike has assumed very formidable proportions, and has caused much distress in the neighbourhood through loss of orders and consequent employment.

In the aggregate, the falling off in tonnage launched during the past year represents 10 per cent. of decrease upon the totals of the previous year, which was the highest on record for merchant ships. The decrease in tonnage under construction at the close of the year was, however, much greater, there being nearly 20 per cent. less work on hand than that at the close of 1906. One feature of the year's shipbuilding has been the proportion of vessels built for abroad, which were nearly 50 per cent. above the normal supply of recent years. This demand has now been mostly met, and the outlook from this point of view is not much better than from that of home consumption.

But if the year's records have proved disappointing as regards quantity, the same cannot be said of the nature of the work turned out, more especially if we include in our comparison ships whose trials took place during the year under review. We have during that period witnessed some remarkable developments in maritime power, in a mercantile as well as a naval sense. The rapidity with which improvements in the design of ships or the means of propulsion have succeeded each other during the past decade has culminated in the achievements of the past twelve months. The notable success of the great Cunarders now running with regularity on their ocean course has reflected the greatest credit upon the constructive powers of our builders of high speed ocean liners. No hitch occurred to mar their continuous progress from the building slip to the quay side, and their performance since the start bears splendid testimony to the care with which the details were worked out and obstacles were foreseen and surmounted. The fulness of time has once again brought the dreams of early pioneers into the region of accomplished fact, and the brilliant but costly experiments of Brunel and Scott Russell have been followed by the great high speed vessels that have reduced the Atlantic passage to the present minimum of time and discomfort. Times have changed since Dickens' first memorable voyage across the Atlantic, and still more since Dr. Johnson described a ship as "worse than a gaol." "There is," he says, "in a gaol better air, better company, better convenience of every kind; and a ship has the additional disadvantage of being in danger." What would this splendid grumbler have thought of the *Lusitania* and *Mauretania*?

The abnormal displacement of these vessels which swelled the return of tonnage launched during [illegible] make the biggest ships of the past year appear small in comparison, yet the number of vessels under construction of over 10,000 tons is still relatively high, and the average size is, generally speaking, on the increase.

Special types of vessels for particular classes of trade continue to claim the attention of naval architects, and boldness and ingenuity have characterized the designs of recent freight carriers. Each year sees fresh advances made towards economy in weight of material, the freeing of hold-spaces from pillars or other obstructions, the increase in the working length of hatchways, and the rendering of vessels more seaworthy when in light condition by the better disposal of water-ballast. The North-East Coast has always been prominent in giving attention to these matters, and the very large and increasing output of that type of cargo-carrier which has become a speciality of the district is significant of the success it has met with among shipowners. A new form of longitudinal construction which has been recently designed, and for which special advantages are claimed, forms the subject of one of our papers at these meetings.

In marine engineering the past year has been noteworthy for the continued and increased employment of the steam turbine for various classes of ships both naval and mercantile, and attention is still focussed upon this form of engine. Its success in the Navy, where it has now entirely superseded the reciprocating engine, has been very marked of late. The First Lord of the Admiralty, in his explanatory statement, says that "all war vessels at present under construction are being fitted with machinery of this type, which has, without exception, proved very successful in the vessels which have been so fitted. The adoption of the turbine has rendered possible that increase of speed which in every type of warship appears as one of the most conspicuous features of recent construction. The 21 knots of the *Dreadnought* has become the general standard of battleship speed in other navies as well as our own; the modern cruisers, notwithstanding their heavy armour and armament are enabled to do their 25 knots an hour, while in the torpedo-boat and destroyer classes some very remarkable results have been obtained with turbine engines and oil fuel during the past few months. The so-called "Tribal" class of destroyers has achieved marked success in this respect. Designed for a speed of 33 knots, they have in most cases exceeded this, one of them—the *Tartar*—having attained not less than 37 knots on one of her measured-mile runs, while the average speed of this boat on a six hours' continuous run worked out at 35·36 knots. In the case of these destroyers, it must be remembered that the conditions of trial were exceptionally severe, and that the fuel consumption came out satisfactory at both full and cruising speeds.

A still speedier though much larger, type of destroyer—the *Swift* of [illegible] tons and with a designed speed of 36 knots—was recently launched at Birkenhead, and will shortly be undergoing her trials. It is confidently anticipated that she will, when completed, be the fastest vessel afloat. What is even more important, however than mere trial speed is the maintenance of speed on service, and from the results obtained it is hoped that these recent types of torpedo vessels will be more successful in this respect than some of their earlier prototypes.

The exclusive use of oil fuel, which has become general in the boilers of these vessels is an interesting feature of their design and the engineering department at the Admiralty are to be congratulated on having successfully overcome the difficulties connected with the use of this fuel—difficulties which at one time appeared almost insuperable. How far reliance upon oil fuel may prove to be rightly placed in view of the limited sources of supply and their general location outside His Majesty's dominions, is a point upon which there appears to be some divergence of views, but the matter may I think be safely left to our technical advisers.

Before leaving the subject of marine engineering, I would call attention to the revival of interest in the superheating of steam for use in marine engines. Constant research along lines likely to lead to economy in marine propulsion has caused engineers to give attention once more to this problem which was first taken up some fifty years ago, but without coming to a satisfactory solution. New conditions, however, have now arisen and superheaters have recently been designed for use on board ship which appear to answer the requirements of service, and conduce to considerable economy

of steam and consequently of fuel. A paper on this subject is to be read by one of our distinguished foreign members, which, I am sure, will be received with interest, and will, I hope, throw further light upon the matter.

A few remarks upon the Navy Estimates that have recently been laid before Parliament may not be out of place. The Navy Estimates this year have been awaited with more than usual interest. The sea of controversy that has raged of late about the rock of British naval supremacy has created a feeling of uncertainty with regard to the measures that were being adopted to ensure the maintenance of our Navy at its relative standard of power and efficiency compared to the other great navies of the world.

The increasing activity in naval construction abroad, and the extension and improvement of ship-building resources outside the United Kingdom, call for the serious attention of those responsible for the naval defences of this country. In the United States there are at the present time twenty-nine warships building, as compared with twenty-two a year ago. These include seven battleships, two armoured cruisers, three scouts, eight submarines and five destroyers, and represent a total money value of over £8,000,000, exclusive of cost of armour and armament. The German programme, which is designed to cover a period of ten years' consecutive building policy, allots an average of over £10,000,000 per annum to new construction and armaments, and provides for four capital ships a year to be laid down for the next few years. In France, a comprehensive programme is being worked to whereby in twelve years' time that navy would possess thirty-eight modern battleships, twenty-six armoured cruisers and scouts, 279 destroyers and torpedo-boats, and 131 submarines. In Russia, the reconstruction of the Navy is being actively pursued.

In the face of facts such as these it must be admitted that the Navy Estimates recently presented to Parliament are remarkable for the moderation they display. The total amount asked for is £32,319,500, being an apparent increase over last year's total of some £900,000; but when allowance is made for the surplus of stores in hand, this figure is reduced to a net increase of only £14,000. The shipbuilding vote, which, more directly than any other, concerns the members of this Institution, is actually less than it was last year by over £500,000—and £4,100,000 less than the corresponding vote in 1904, since which time it has been steadily decreasing. When it is remembered that the cost of individual units has during this period increased enormously, it is obvious that the number of ships of each class which can be built from this year's programme must consequently be small. Two large armoured ships (one a battleship, the other a cruiser), six fast but small protected cruisers, sixteen torpedo-boat destroyers, and a number of submarines—such is the total amount of new construction proposed. It is quite evident from this programme that the axiom laid down by the Board of Admiralty three years ago with regard to the necessity of building each year four large armoured ships has been abandoned—at any rate for the time being. Moreover, of the sums now asked for, the Government only propose spending a very small proportion on new ships during the current financial year.

No adequate reason has, so far as I am aware, been vouchsafed for this change of policy. It has been stated that our present position is unassailable, and that our facilities for rapid construction are a valuable asset. Both these contentions are true for the moment. But our position will only continue to be unassailable if we take the necessary steps for maintaining it; and as regards the value of speed of construction this must not be over-rated. It is only of value if others do not achieve it. The monopoly—if it can be so called—of rapid building may be ours to-day, but not to-morrow for no unprotected monopoly can exist for long in the manufacturing world. There is on the face of it no intrinsic reason why other nations whose yards are equipped with modern plant and whose demand for skilled workmen is kept fully supplied should not turn out warships in as short a space of time as our own dockyards or private builders. Our relations with Foreign Powers—notwithstanding occasional attacks of newspaper fever—are fortunately friendly, and for the moment no serious complications overshadow the political horizon. But no Government can afford to confine to the immediate necessities of the moment the demands which it must make upon the resources of the nation to provide for the needs of the future. And yet this is apparently what is being done at the present time. "Sufficient unto the day is the evil thereof" appears to be the principle upon which this year's Naval Estimates have been based. I venture to say that no more mischievous principle could be applied to our national defences. A hand-to-mouth policy is one that can only increase our difficulties in the near future, and a very heavy outlay will be needed before long if our standard of naval strength is to be maintained. That standard is admittedly on a rapidly falling gradient as regards new construction at the present moment.

No one doubts for a moment that, should urgent necessity arise, the Government of the day, to whatever party it might belong, would readily vote such sums as its official advisers considered needful. The country would not be satisfied with anything less. But to found a policy of procrastination upon the uncertain value of this eleventh hour remedy is surely to jeopardize our naval position, and saddle the future with an unknown and possibly unlimited liability.

I have been led to speak strongly upon this point, as I feel convinced that the only real economy possible in naval affairs is that which is consistent with the maintenance of our naval superiority. With the resources at their disposal, it must be admitted that the present Board of Admiralty have displayed great energy in carrying through various measures for maintaining our naval construction in the forefront of the navies of the world, and the wisdom of a forward policy in the constructive and engineering departments at Whitehall has been fully vindicated. The successful introduction of far-reaching changes in mechanical forms of propulsion is indicative of the high standard of technical knowledge and practical experience attained at our great naval centres. In our private ship and engine building establishments and armour-plate works the standard is nowise lower; the mechanical plant in both Government yards and private works has of late years been brought very generally up to date; our supplies of skilled workmen are still large enough to meet all probable demands and their ranks are being continually re-enforced through the increased facilities now available for technical education. Such factors as these are national assets upon which we may base the estimate of our resources in the domain of naval construction. Provided only that the necessary funds are voted by Parliament, we need have no fear for the quality of the ships and material that contribute so largely to the maintenance of our supremacy afloat.

Before proceeding to the business of the meeting, I wish to take this opportunity of alluding to a matter of more special interest to myself. It has now been my privilege to address you from this chair for upwards of seven years, and, much as I have valued the honour of presiding over the interesting meetings it has been my good fortune to attend, I feel that the time has come when a change in the occupancy of the presidential chair might well be made. The calls upon my time seem to increase rather than diminish as the years roll by, and make it difficult for me, living at a distance from London, to attend the meetings of the Council as frequently as I should like to do. Moreover, there is no doubt that the vitality of an institution such as ours is best kept up by occasional infusion of "new blood" at the head of its affairs. It is with feelings of real regret that I came to this conclusion, which I have as stated in the annual report, already communicated to the Council. I find it hard to put into words my feelings on quitting the office which I have esteemed it my highest privilege to have held for the last seven years, but I can truly say that I look back upon my period of office with unmixed pleasure. I have had from my colleagues on the Council the advantage of their unvarying support, kindness and consideration and from the secretary and his staff able and willing assistance at all times. I can bear testimony to the harmony and goodwill that have characterized our meetings and I can recall, I am happy to say, no untoward incident during the period of my connection with this Institution.

I am well aware of my own limitations, but as far as lay in my power, I have endeavoured to further the objects for which this Institution was founded. I may, perhaps, be permitted in taking leave of the office of president, to observe with satisfaction that the Institution, judged by its well-attended meetings, by the valuable papers and discussions recorded in the Transactions and its ever-growing membership, continues to fulfil its useful function and to attract

members from all those parts of the world where shipbuilding and marine engineering claim attention. That it will still continue to do so under the able guidance of a Council so fully representative of the industries with which it is associated I have no doubt whatever. My interest in its future will remain unabated, and it is with feelings of entire confidence in their realization that I will conclude these remarks by offering my heartiest good wishes for the success and prosperity of the Institution of Naval Architects.

Lord Glasgow then reported that the Council had asked Earl Cawdor to succeed him as president; this was put to the meeting and amidst applause Earl Cawdor was unanimously elected.

The president then proceeded to present premiums to Messrs. J. Hamilton Gibson and Lyonel Clark for their papers, as previously noted in the council's report. The recipients having returned thanks, Mr. C. Tennyson, in the absence of the author of the paper, General E. E. Goulaeff, was called upon to read a paper on "Unsinkable and Uncapsizable Ships of the Goulaeff Form and System of Construction," in which the author advocated the construction of broader and shallower vessels, provided with treble wire longitudinal cellular side corridors, which were rendered possible by the increased breadth of the ship, and were intended to reduce to a minimum the quantity of water that might enter through damages or openings made in the under-water skin.

In the discussion which followed, doubts were expressed as to whether General Goulaeff had succeeded in solving the problem to which he had directed his attention, Admiral Fitzgerald mentioning that the ship might be uncapsizable, but it would not be unsinkable if a mine exploded beneath her.

The president having moved a vote of thanks to the author, and this having been duly carried, Mr. C. E. Ellis read, in the absence of Captain T. J. Tresidder, the author, a paper on "Modern Armour and its Attack." As this paper is dealt with elsewhere in our pages, we will not further refer to it here. The discussion was opened by Mr. Ellis, who congratulated the author on an extremely interesting contribution, Mr. Hadfield and Captain Tucker also taking part.

The third paper, read by Mr. J. E. Thornycroft, on "Modern Torpedo Boats and Destroyers," we are giving in our next issue. Mr. Sydney Barnaby in the discussion which followed expressed the sympathy of the gathering with all those concerned in the disaster to the *Tiger* off Portsmouth.

Two of the further papers read we give in full, and the others we refer to in our Editorial Notes, space alone preventing our reporting the discussions. The proceedings terminated with the usual votes of thanks to the Society of Arts, the President and Council.

Motors.—The exhibition held at Olympia, and which closed on April 4th, proved that a great advance had been made in the constructional details of motors during the past year. The Motor Exhibition of 1907 was largely confined to private vehicles, that of 1908 was more devoted to those adapted for the purposes of trade and commerce. The variety was great, and both the mechanism and style of conveyances showed a display of method and ingenuity which gave the visitor the impression that in this department of our national manufactures surely Britain stands well to the front. The annexe of the Exhibition was devoted to the marine section, and here the improvement over last year was marked in several directions. The boats, as usually presented to our view in all the Exhibitions, were models of beauty and finish, each specially built to suit the purpose designed, whether for knocking about harbours, for sea coast or for up-river. The conveniences for handling the machinery, overhauling, minimising risk of back-firing and of total disablement of the motive power, were conspicuously presented to the eye of the marine engineer and revealed the fact that the internal combustion engine is gradually increasing in size and capability, with a view to a larger field of usefulness on the ocean. One motor in particular we studied with interest as we witnessed the details of one section being disconnected and the whole opened up for examination while the remaining sections continued at work without cessation. Here seemed to be an ideal motor for sea going work, and no doubt the progress made in the design workmanship and accessibility warrant us in looking forward to a greater development with this class of motive power.

THE COMBINATION SYSTEM OF RECIPROCATING ENGINES AND STEAM TURBINES.*

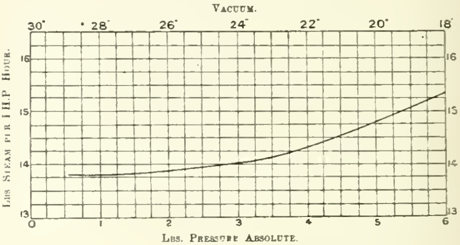
By the Hon. C. A. Parsons, C.B., F.R.S., D.Sc., M.A., Member of Council; and R. J. Walker, Esq., Member.

In the early years of steam turbine design and development it became apparent that the turbine engine was capable of economically dealing with ratios of expansion far beyond the reach of any reciprocating engine whose limitations in this respect had been experimentally determined by many investigations.

In 1889 the first condensing turbine of about 100 H.P. was designed for an expansion ratio of 100 by volume, the expansion being effected in two turbines of the double parallel flow type, the low-pressure turbine (Fig. 1) taking steam from the exhaust of the high-pressure at atmospheric pressure and expanding it down to 1 lb. absolute.

Fig. 2.

Effect of Vacuum upon Steam Consumption of Triple-Expansion Reciprocating Engine of 200 I.H.P.



Effect of Vacuum upon Steam Consumption of Steam Turbine of 1,000 K.W. Turbo-Generator.

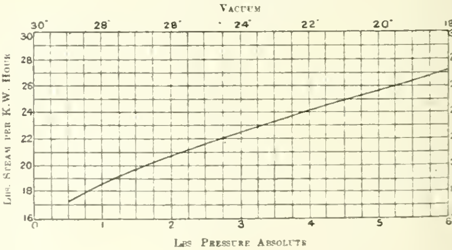


Fig. 3.

The striking feature presented by this design was the very high estimated efficiency of this low-pressure portion.

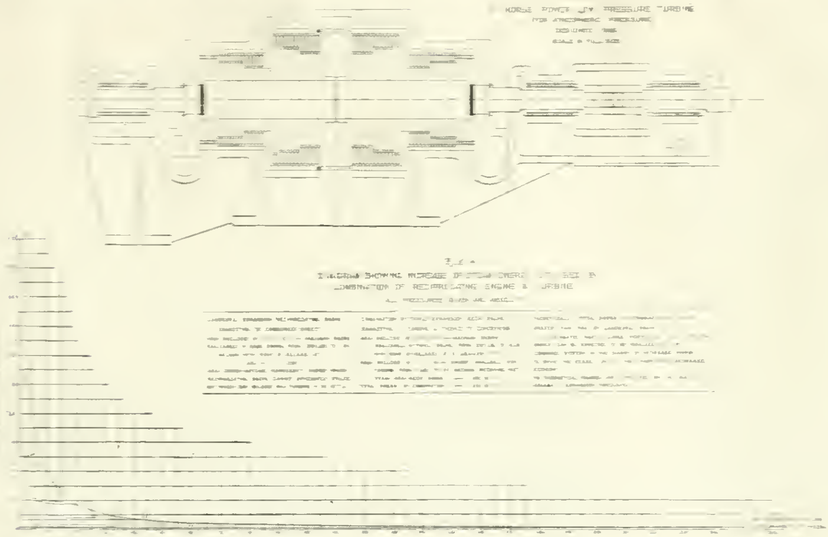
A separate low-pressure turbine was not, however, actually constructed till some years later.

In 1894 a patent was taken out for the "combination" of a reciprocating engine with a steam turbine whose object was "to increase the power obtainable by the expansion of the steam beyond the limits possible with reciprocating engines." The previous treatment of the steam is, of course immaterial, provided that its condition of pressure and wetness on reaching the engine are known.

The first instance of a separate turbine worked from the exhaust of other turbines was in the *Turbinia's* machinery in 1897—the pressure at entry of her low-pressure turbine was about 9 lbs. absolute, and the exhaust 1 lb. absolute.

* Read at the Spring Meetings of the Forty-ninth Session of the Institution of Naval Architects, April 9, 1908.

[illegible]


HORSE POWER LOW PRESSURE TURBINE
DIAGRAM SHOWING INCREASE OF ... COMBINATION OF RECIPROCATING ENGINE & TURBINE

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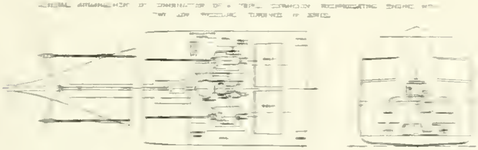
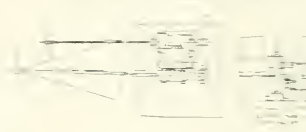
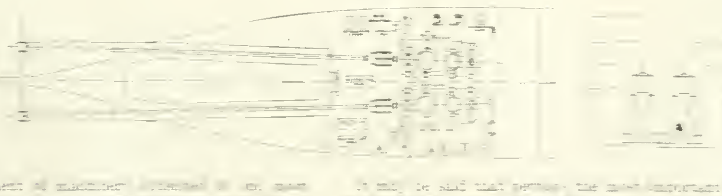






[illegible]

suited for it, and the turbine utilizing that portion of the expansion diagram which the reciprocating engine is not able to utilize efficiently.

It is generally well known that an all-turbine arrangement has not been advocated by us for ships where the designed speed falls below 15 or 16 knots, excepting in some special cases such as yachts; and for vessels of moderate or slow speed, the combination system of machinery appears to be eminently suitable.

In a good quadruple reciprocating engine, the steam is expanded down to the pressure of release, about 10 lbs. absolute, and gains in economy as the vacuum is increased up to about 25 in. or 26 in., whereas, in a turbine, it is possible to deal economically with very low-pressure steam and to expand this low-pressure steam to a low absolute pressure corresponding to the highest vacuum obtainable in turbine practice.

Figs. 2 and 3 on page 392 show the effect of vacuum upon steam consumption as the result of tests carried out on a reciprocating engine and steam turbine respectively, from which it will be noted that, whilst the curve for the reciprocating engine gives the minimum consumption at between 25 in. and 26 in. vacuum, the curve for the turbine continues to fall rapidly as the vacuum increases.

Fig. 4 shows, in diagrammatic form, the advantage of the combined system of machinery. The total area of the diagram represents the maximum energy that could be obtained, theoretically, from the steam, if it were expanded down to the pressure in the condenser. The area enclosed by lines A, B, C, D and E shows the theoretical maximum energy realizable in a quadruple engine from 200 lbs. pressure to 26 in. vacuum, and the area cross-hatched the additional energy that can be utilized in a turbine, but which cannot be economically used in a reciprocating engine.

In a combination system, the most suitable initial pressure for the turbine, or the dividing line between the reciprocating engine and the turbine, will greatly depend upon the conditions of service of the particular vessel taken. The reciprocating engine, or engines, could be designed to exhaust at a pressure of between 8 lbs. and 16 lbs. absolute, or even at a slightly higher pressure, if necessary to meet the conditions required. From an estimate of the theoretical efficiency under the various conditions of pressure as set forth in the following table, it would appear, apart from any practical considerations, that there is nothing to choose between an initial pressure at the turbine of between 7 lbs. and 15 lbs. absolute, any pressure within this limit appearing to give the most economical result.

in "series," or two turbines in "parallel" could be fitted, each turbine driving a separate shaft in addition to the reciprocator shaft. With twin-screw reciprocating engines, an arrangement of one turbine in the centre of the vessel, two turbines in "parallel," or two turbines in "series" could be adopted. The arrangement which seems to commend itself generally to shipowners and builders, where twin-screw reciprocating engines are fitted, is the arrangement with the turbine on the centre shaft.

In 1901 and the two or three following years alternative schemes were prepared from time to time. Fig. 5 shows an arrangement which was prepared in 1901 of a single reciprocating engine in combination with two low-pressure turbines in "series." The indicated horse-power of this proposal was 1,500, speed 11½ knots, and loaded displacement 5,300 tons. Fig. 6 shows another arrangement of one reciprocating engine, and a turbine on one side of the vessel. The I.H.P. of this vessel was 1,200 total and the speed 10 knots.

The turbines in each proposal were designed for about 25 per cent. of the power and the reciprocating engines the remainder, the turbines taking the steam from the reciprocating engines at 7 lbs. absolute pressure. It was estimated that the combination as applied to cargo vessels would be about 15 per cent. to 20 per cent. more economical than the ordinary triple-expansion engines usually fitted to this class of vessel.

Owing to the rapid development of the turbine industry for high-speed work and the attention which was, in consequence, paid to this branch of the business generally, the development of the combination system fell more into the background than its merits and the wide scope of its application would seem to have deserved.

About two years ago, at the suggestion of Sir William White, designs were prepared of a combination system as applied to the intermediate type of liner of moderately large power and speed, and since that time numerous designs have been prepared for various types of vessels of speeds ranging from 13 to 16 knots.

By the courtesy of Messrs. Swan, Hunter & Wigham Richardson, who, for a considerable period, have taken much interest in this combination of machinery, the figures in the table are given of the comparative sizes of engines, power, etc., of the "combination" as compared with twin-quadruple engines for a proposed steamer of 490 ft. in length, 13,600 tons displacement, 7,200 I.H.P. and 15½ knots speed.

In the combination proposals set forth in columns B and C in the following table, it may be mentioned that in this particular inquiry the shipowners wished to have the advan-

	Initial pressure turbine.	Reciprocating engine back pressure.	Theoretical B.T.U. per lb. of steam. R.E.	Turbine.	Total.
Assuming 200 lbs. absolute at Reciprocating Engine to 28 in. vacuum at condenser	15	16	178	142	320
	12½	13½	189	131	320
	7	8	218	100	318

In the case of a vessel which runs on service continually at or about her designed full speed, an initial pressure of about 7 lbs. absolute at the turbine appears most suitable. In a vessel which does part of her running at the designed power and part at a considerably reduced power, it is desirable to design the turbines so that the initial pressure would not fall below 7 lbs. absolute when running under the lower conditions of power.

It might be of interest at this stage to consider the disposition of the turbines in combination with reciprocating engines on board ship. The arrangement of the turbine, or turbines, depends greatly upon whether the vessel is to be fitted with single or twin-screw reciprocating engines. With a single reciprocating engine, one turbine, two turbines

tage of the additional power and increase in speed of the vessel on the same coal consumption as for the twin-quadruple engines. In some instances an increase in speed might not be desired, in which case the boilers and engines could be reduced in size by the estimated amount of saving in consumption, so that the total indicated horse-power of the combination did not exceed that required with twin-quadruple engines. This would considerably reduce the total weight of machinery and also the bunker capacity for a given distance. This saving in the weight of the machinery and in the bunkers would enable the vessel to carry an equivalent addition in deadweight cargo. Then, again, if we take the indicated horse-power of 8,300 for the combination and assume that quadruple engines and boilers were required to

give an equivalent power, the extra total weight of machinery would be, roughly, 160 tons, in addition to an increase of about 12 per cent. in coal consumption for the same power.

Fig. 7 shows an arrangement of twin-quadruple engines corresponding to particulars given in column A of the following table. Fig. 8 shows an arrangement of twin-triple-expansion engines, working in conjunction with two low-pressure turbines, as set forth in column B, the reciprocating engine on each side exhausting into a turbine. By this arrangement an independent set of engines is obtained on each side of the vessel. Fig. 9 shows an arrangement of four-crank triple-expansion engines and one low-pressure turbine, as set forth in column C.

In arrangements shown in Figs. 8 and 9 for manœuvring in and out of port, suitable arrangements are made for changing the flow of steam of the L.P. cylinder exhaust of the reciprocating engine from the turbine to the condenser. This can be done in two or three ways. One method is to have an ordinary change valve of the piston type, or ordinary double-beat spring-loaded valve actuated by links connected to the weigh shaft of the main engine, which would automatically change the flow of steam to the condenser when the engine was reversed. With this arrangement, when going ahead on one side of the ship the steam from the reciprocating engine would flow through the turbine; but there does not appear to be any objection to this, even if we consider the

Fig 8.

GENERAL ARRANGEMENT OF COMBINATION OF TWIN TRIPLE EXPANSION ENGINES AND TWO LOW PRESSURE TURBINES IN PARALLEL OF TOTAL HORSE POWER OF ABOUT 8300.

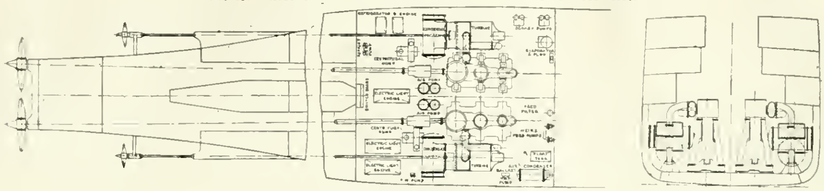
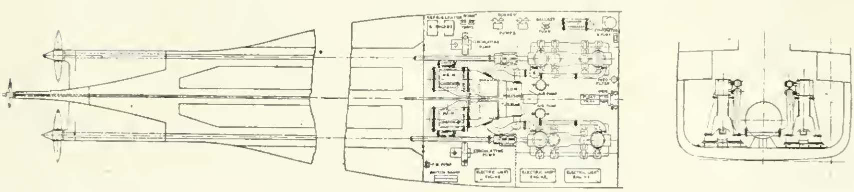


Fig 9

GENERAL ARRANGEMENT OF COMBINATION OF TWIN 4 CRANK TRIPLE EXPANSION ENGINE AND ONE LOW PRESSURE TURBINE OF TOTAL HORSE POWER OF ABOUT 8300.



	A	B	C
	Twin-Quadruple Reciprocating Engines.	3-Cylinder Triple-expansion twin Reciprocating Engines, with two Low-pressure Turbines in parallel.	4-Cylinder Triple-expansion Twin Reciprocating Engines, with one Low-pressure Turbine.
Dimensions of Reciprocating Engines	25, 36½, 51½, 75 / 55	27, 42, 66 / 48	26, 39, 46, 46 / 42
Revolutions of Reciprocating Engines	84	85	100
Piston speed of Reciprocating Engines	770	680	700
Boiler pressure	213 lbs.	213 lbs.	213 lbs.
Estimated pressure at H.P. Receiver	200 lbs.	200 lbs.	200 lbs.
Initial pressure Turbines	—	7 lbs. absolute	7 lbs. absolute
Vacuum at Condenser	26 in.	28 in.	28 in.
Steam consumption, Main Engines only	95,000 lbs. per hour	95,000 lbs. per hour	95,000 lbs. per hour
I.H.P. Reciprocating Engines	7,300	6,300	6,300
Estimated equivalent I.H.P. of Turbines	—	2,000	2,000
Total I.H.P.	7,300	8,300	8,300
Per cent. increase power	—	13·7 per cent.	13·7 per cent.
Estimated speed	15·5 knots	16·2 knots	16·2 knots
Steam consumption, lbs. per total I.H.P. per hour Main Engines	13 lbs.	11·45 lbs.	11·45 lbs.
Steaming weight of Engines and Boilers (Reciprocating Engines)	—	1,430 tons.	1,455 tons.
Weight of Turbine Installation	—	65 tons.	70 tons.
Total steaming weight	1,560 tons	1,495 tons	1,525 tons
Revolutions of Turbines	—	480	320

twin-screw reciprocating arrangement with a single turbine on the centre shaft. It might be rather an advantage than otherwise to allow the steam from the engine going ahead to pass through the turbine, as the centre propeller revolving would accelerate the feed of water on the rudder and augment the turning power of the vessel. Figs. 10 and 11 show such arrangements.

Another method would be to work these valves independently of the main engines, actuated by a hydraulic engine or by an ordinary steam-driven reversing engine. With this arrangement the low-pressure turbine would be cut out altogether and the reciprocating engine would exhaust to the condenser, whether going ahead or astern during manœuvring.

Enough has perhaps been said as to the general arrangement and estimated economy obtainable in the combined system, and now it may be of interest to refer to the general application of the system.

The development of the combination is already rapidly taking place on land, where the exhaust steam from non-condensing engines, especially the winding engines at collieries, and rolling and mill engines, is being utilized in low-pressure condensing turbines. There are, at the present time, some

Messrs. W. Denny & Bros. are also at present building a vessel for the New Zealand Shipping Company, which is being fitted with the combination system of twin triple-expansion engines and one low-pressure turbine. This vessel is an exact repeat of two other vessels Messrs. Denny have built for the same owners, except as regards type of engines.

In addition to the above, the Turbinia Works, in conjunction with Messrs. A. Stephen & Sons, of Glasgow, are fitting the combination system to the yacht *Emerald*. In this vessel, which was one of the first to be fitted with an all-turbine arrangement, it is intended to make some modifications to the existing arrangement of machinery by introducing a reciprocating engine on the centre shaft in lieu of the high-pressure turbine at present in the vessel. This engine will be of the high-speed enclosed self-lubricating type, and is now being constructed by Messrs. J. S. White & Co. It is designed to exhaust into the two low-pressure turbines at about 15 lbs. absolute pressure, the dimensions of the engine being $\frac{12\frac{1}{2},\ 19,\ 30}{18}$ and revolutions about 350. It is expected that this vessel will be ready for trials in about four months' time.

Fig 10

PLAN SHEWING AN ARRANGEMENT OF PISTON TYPE CHANGE VALVES BETWEEN THE RECIPROCATING ENGINE, TURBINE & CONDENSER IN A COMBINATION SYSTEM WORKED FROM MAIN ENGINE.

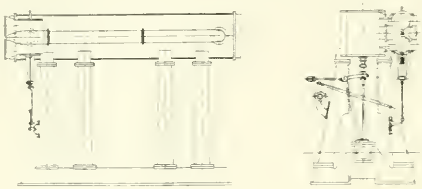
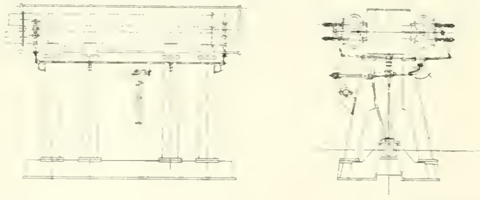


Fig 11

PLAN SHEWING AN ARRANGEMENT OF DOUBLE BEAT CHANGE VALVES BETWEEN THE RECIPROCATING ENGINE, TURBINE & CONDENSER IN A COMBINATION SYSTEM WORKED FROM THE MAIN ENGINE.



twenty-four of these installations of the Parsons type delivered, working and under construction, ranging from 125 kilowatts to 1,250 kilowatts, representing a total brake horse-power of about 17,000. In most cases the exhaust steam is supplied to the low-pressure turbine at 15 lbs. absolute pressure and a vacuum of 28 in. and under such conditions about an equal amount of power can be obtained from the turbine as from the non-condensing reciprocating engine; thereby doubling the power of the plant without any further consumption of fuel. From several tests made with these exhaust turbines on land, a consumption of about 34 lbs. per K.W. hour can be obtained in a 500 K.W. machine with an initial pressure of 15 or 16 lbs. absolute to 28 in. vacuum.

In regard to marine installations, the combination is being fitted to a large vessel at present under construction at the works of Messrs. Harland & Wolff for the Montreal trade of the Dominion Line. The arrangement of machinery in this vessel is substantially as described in column C of the table [illegible] referred to [illegible] twin four-crank triple-expansion [illegible] exhausting into one low pressure turbine driving [illegible] the shaft.

REVIEW.

Iron and Steel. (6/-). By J. H. Stansbie. London: Constable & Co. 1907.

The author is a chemist and treats his subject from this point of view. We have the iron in its various chemical forms found in nature, followed by the materials used in manufacture and the system employed from ancient times. This leads up to modern forms. We have the puddling furnace presented to us and the difference between iron and steel, with the various processes the latter goes through in the course of manufacture. The author appears to us most practical in his descriptions and there is nothing lacking here to give a clear comprehension of the subject. We have all the mechanical treatment involved in the various stages, and then with the properties we have the testing instruments employed and the way the microscope is called in. The application of electricity is noticed by many examples and the author concludes by a chapter on special steels. It will therefore be seen he leaves no point untouched and has produced, we think, a volume of value which is likely to be a standard one.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

Old Steamships.

THE announcement has just been made that the steamship *Sophocles* of the Aberdeen line has been sold out of the service through Messrs. Kellock's of Liverpool. This vessel, which has been employed for some years in the passenger trade between London and Australian ports, was formerly the *Ionic* of the White Star Line. When hailing from Liverpool she ran in the New Zealand service in conjunction with the vessels of the Shaw Savill and Albion Company. Her engines were originally of the tandem compound type which became so well known in the earlier days of Messrs. Harland & Wolff's fame. In the year 1894 she had new boilers, and her engines were at the same time converted to the quadruple-expansion type. In 1900 she was transferred to her recent owners and she has now gone to Morecambe Bay to be broken up. The best-known incident in her career was probably the occasion on which she broke her shaft in the Atlantic and was towed into port by the Castle Company's mail steamer *Hawarden Castle*—a vessel which has long since ceased to be in the Cape trade.

It is not long since I chronicled the breaking up of the old P. & O. *Ceylon*, a vessel built just half a century ago, and for some years employed in the public yachting business. Her most recent owners had been the London Polytechnic, which used her for semi-educational tours. I see now that she has been replaced in this business by another famous mail steamer of bygone days. This is the *La Plata*, just bought from the West India Royal Mail Steam Packet Company. But this vessel's employment for her recent owners was by no means the best-known stage in her career, for before they bought her in the year 1901 and changed her name she was the well-known Cape liner *Moor* of the old Union Steamship Company.

Among the several wooden steamers which have been crushed in the ice whilst sealing off the Newfoundland coast at the beginning of the month may be mentioned one which began life nearly half a century ago as H.M. gunboat *Landrail*. Her history in several ways takes one back to ancient surroundings, for she was built in the long-closed Royal Dockyard of Deptford.

Disasters.

The inquiry into the stranding of the Union Castle liner *Newark Castle* has now been held and it is pleasant to record that the Court of Inquiry, whilst finding that the loss of the vessel was due to the striking of an uncharted obstacle, and that her abandonment was necessary owing to the risk of her capsizing, took the opportunity to remark on the discipline resource and courage shown by the master, officers and crew of the unfortunate steamship.

The Nord-Deutscher Lloyd have met with a casualty which promises to be serious. Their Mediterranean passenger steamship *Hohenzollern* on her way between Marseilles and Alexandria, struck near Alghero, off the coast of Sardinia, and remained. At first the casualty was considered by no means important, one sapient telegram from Berlin explaining that the vessel only touched ground with her anchor and got off immediately! I like that idea of the fact that the anchor touched ground being a matter which would need reporting at all. In British ships we imagine that touching, or better still, biting, the ground is the object for which anchors are used. But to proceed. The matter turned out to be more serious and important than had been at first admitted. Though alleged to be lying on the sand the vessel sustained bottom damage and some cargo was discharged. Then a fruitless attempt to tow her liner off was made by a steam tug and the Italian battleship *Sardegna*. The company's steamer *Therapeia*, having taken on board such of the cargo as had been salved, proceeded to Alexandria with it and the *Hohenzollern's* passengers. On the 13th April during a south-westerly gale the stranded vessel filled with water and was then reported as probably a total loss.

The *Hohenzollern* was built at Stettin by the Vulcan Company in the year 1889. She was then called the *Kaiser Wilhelm II.*, retaining that appellation until it was taken from her to be given to one of the express vessels of the fleet, when the older ship was given the family name of the Imperial family, the title being set free by the elimination from the fleet of a smaller and more ancient *Hohenzollern*. The vessel which has stranded was of just under seven thousand tons gross register and was one of the last of the big passenger liners of the company constructed on the single-screw principle. She was first of all employed in the New York and Australian services. After her change of name in 1901 she ran in the Mediterranean line, and then was put on the service between Marseilles and Alexandria, in which she was employed at the time of her stranding. In February, 1906, she broke her shaft off the island of Crete and the propeller shaft, when fractured, holed her hull. She was, however, towed into Suda Bay by the steamship *Siam* and the leak was stopped by divers. The *Siam* flew the Austrian flag, and, of course, the *Hohenzollern* belonged to a German company. Yet the English Admiralty Court was called upon to adjudicate on the claim which was made and awarded a sum of £2700 for the work of salvage. The disabled vessel was taken to Genoa and repaired, and then restored to her ordinary service. Throughout her whole career she has been considered a very comfortable vessel by passengers, and at the time of this her latest and probably final casualty, had on board no less a personage than Admiral von Tirpitz, Minister of the Imperial German Navy.

Whilst this loss has to be recorded, there is, on the other hand, to be noted the successful close to the operations on the Canadian Pacific Company's twin-screw liner *Mount Temple*, which stranded on West Ironbound Island as long ago as the beginning of December, 1907. This vessel was at first considered a hopeless wreck, her bottom having been badly holed. Yet after she was floated on the 15th April, it was found possible to use her own steam and to take her into Halifax with her starboard engines working—a fact which reflects great credit on the workmanship of her builders, Messrs. Armstrong, Whitworth & Co.

Kingstown Pier.

A curious struggle is going on at Kingstown between the City of Dublin Steam Packet Company and the Crown. For many years the City of Dublin Company has had the practically exclusive use of the Carlisle Pier at Kingstown for the landing and embarkation of mails and passengers, the steamers of the London and North-Western Railway—which, like the Dublin company, make Holyhead their English (or Welsh) terminus—going to the North Wall, Dublin, at the western end of their voyage. But the Post Office entered into an arrangement, which came in force at the beginning of April, whereby a day mail was to be carried by the Railway Company's steamers and to be landed at Carlisle Pier. To this arrangement the City of Dublin Co. took exception, alleging that they had the exclusive use of the pier, and further that to allow any one else to use it would entail not only a probable interference with the due delivery of the mails but also a possible risk to human life. In support of this contention they invoked the Court of Chancery in England, and sought an expression of opinion from Mr. Justice Eve which should amount to an injunction to prevent the Crown from allowing the North-Western liners to use the pier. The action remains to be tried, but a the preliminary hearing the Dublin people failed to make out any case for *interim* interference. So the Railway Company's steamer proceeded to the pier, to find the berth occupied by a Dublin mail boat. The harbour authorities called on the Dublin people to make way. But they only yielded under pressure and subsequently put further obstacles in the way of the use of the pier by their rival's vessels. In the result there have been police court proceedings in Dublin and further appeals to Mr. Justice Eve. The latter spoke of the truly Irish action of the Dublin Company as being such as one would have expected of them if he had found in their favour instead of against them. Indeed, it is evident from what has passed in the House of Commons, as well as in the Courts, that the whole matter is looked upon as another grievance of the "disthressful counthry," and indeed as a personal affront to some of the more highly placed officials of the Board. By no means the last of the matter has been heard, and it will be curious to see if the Postmaster-General will be able to withstand political pressure and to continue his arrangement with the railway steamers in face of the hostility thus excited over a purely business undertaking.

Troubles of a Steamship Company.

There have for some time been rumours as to the position of an old-established Liverpool firm, and in the middle of the month it transpired that Messrs. Leech, Harrison & Forward are about to execute a deed of assignment of the property of their own and their London and New York houses in favour of their creditors. Messrs. Forwood's were until a few weeks ago the agents in Liverpool of the Hamburg-American line in respect of the Atlas steamers which, founded by them, were some years ago absorbed by the great German company. Their Mersey Steamship Company comprises some half-dozen favourite passenger vessels engaged in the trade to Morocco and the Canary Islands. To this fleet have recently been added two exceedingly comfortable vessels which have been making a favourable reputation with tourists in the one or two voyages which they have as yet accomplished.

The Atlantic Record

has, over the long sea route, been captured from the *Lusitania* by her sister *Mauretania*, which claims to have lowered the time of passage by a single minute! When one realizes the method in which the timing of these voyages has to be taken, one appreciates how difficult it must be to take the time to so close a definition, and the idea of claiming a single minute in this way seems a little absurd.

The Chargeurs Reunis of Havre

have arranged a round-the-world service. The steamers will sail at forty-five days' intervals and will start from Antwerp, calling at Dunkirk and La Pallice before entering the Mediterranean, where they will make several stoppages before reaching the Suez Canal. Eventually they will find their way to Hong Kong and thence to Chinese and Japanese ports. Crossing the Pacific they will put into Canadian and United States ports and then find their way down the coast to the Straits of Magellan, and so home *via* the ports of the River Plate, the whole journey taking some seven months.

The White Star Company

has now announced that its new steamer will be ready in two years' time, though I do not gather that work upon her is actually commenced as yet. She will be a magnified *Adriatic*. That is to say, her speed will be low. But her engines will be on the mixed reciprocating and turbine principle, which has been so favourably spoken of by Mr. Parsons at the recent meeting of the Institution of Naval Architects. Her dimensions are to be much in excess of any vessel afloat —probably even of the postponed leviathan of the Hamburg-American line. But it seems hardly likely that she will run to the 1000 ft. of length which has been suggested for her.

Meanwhile the Company intends to develop the Canadian trade, entering it next season with the *Baltic* and a new ship of the same type now under construction. These two ships are to sail in conjunction with the *Albany* and the *Alberta* of the Dominion line, which were ordered from Messrs. Harland & Wolff last year, and one of which is to be the first steamer to have the mixed installation of machinery of which I have spoken. It would appear that the competition in the Canadian trade will be severe indeed, as not only is this attack to be made by the companies of the International Mercantile Marine, but the Nord-Deutscher Lloyd intends to send its steamers in future to Halifax, their new steamer the *Lutzow*, which is appointed to leave Bremen for New York on the 16th May on her maiden voyage, being scheduled to make the first call.

In furtherance of their scheme for educating their own officers, the White Star Line have bought the full-rigged ship *Mersey* from Messrs. James Nourse, and intend to use her as a training ship for cadets.

The P. & O. Company

has just commenced the working of its new Australian Mail Contract with the British Post Office. Under it the time of transit to Adelaide will be a day shorter than it has previously been. The steamers recently provided by this company are more than equal to any call that is likely to be put upon them for speed, and the *Macedonia* has just shown something of her powers by cutting the record between Fremantle and Colombo, reducing the passage between these two ports to seven days twenty hours.

Public Yachting

seems to be becoming more and more fashionable. The P. & O. Company, for example, are sending their ss. *Vectis*, which is now entirely devoted to this work, for Mediterranean cruises in May and June, the Orient line are sending their *Ophir* to the Canary Islands and other ports in the middle of May; and now it is announced that the West India Royal Mail are to despatch one of their bigger vessels on a tour in the immediate future. And this is all in addition to the several public yachts which are owned and worked quite independently of any regular line of steamers.

The "Borussia."

It will be remembered that the *Borussia*, a large steamer of the Hamburg-American Line, took a list and sank at Lisbon when coaling in the closing months of last year. Not only was the ship herself a new and valuable vessel, but she had a cargo of coffee aboard whose value ran into many thousands of pounds. The cause of her loss was the heeling over of the ship when coaling, the tide at the time being exceptionally strong, even for the Tagus. It is said that the underwriters on the coffee cargo are contemplating the bringing of a test suit against the steamship company for the losses which they sustained by the destruction of the cargo, the allegation being that the casualty was due to the negligence of those in charge of the vessel. A good deal will, of course, turn on the wording of the bills of lading under which the cargo was carried, for I take it that underwriters, neither in this country nor abroad, can stand in a better position in such a matter as that under discussion, as against the shipowner, than the owners of the cargo in whose shoes they stand. But the point, if fought, will be of interest to other shipowners than the Hamburg Line. For we most of us remember that British steamship companies, notably the Orient line with its *Austral* and *Oratava*, have suffered from casualties by listing, though fortunately in the case of the two steamers named there was not, so far as I can recollect, much, if any, loss of cargo.

The Port of Fishguard

continues to progress, though how far as yet it is making any return on the huge capital embarked in it by the Great Western Railway Company remains to be seen. It has become, in a modified way, a port of call for ocean steamers, inasmuch as the Booth Liner *Lanfranc* disembarked her passengers there on her last homeward trip, they being run up to London by a non-stop special train immediately on arrival. Now the *St. Andrew*, the fourth vessel of the Rosslare fleet, has been delivered by the Clydebank firm after most satisfactory trials, her mean speed on trial exceeding twenty-three knots, which is half a knot in excess of what was contracted for. This vessel is a sister to the two turbine-engined ships already built for the Fishguard service by the same yard. It will be remembered that the fourth vessel of the quartette was constructed at Birkenhead.

The Cunard Service

being semi-weekly to New York, it has become possible to get increased work out of the new ships by means of a careful re arrangement of the time-table. Had the old arrangement been adhered to, the fast ships would have spent six days out of every fourteen under steam and eight days in harbour. This seemed an extravagant method of procedure, and so by transferring some of their sailings from New York to Wednesday instead of Saturday, the *Lusitania* and *Mauretania* will be able to be turned round in three weeks instead of four. As some of the great items of cost in respect of these ships are interest and depreciation, which run on whether they be at work or idle, it is obvious that the new arrangement will largely increase their earning power. In this connection, by the way, it may be remarked that the recently issued report and balance sheet of the Cunard Company was a highly satisfactory document. The prosperity of the great English company, which stood alone for so long against the attacks of so many and powerful rivals, is the more remarkable when it is remembered that the year 1907 was not by any means a good year for some Atlantic lines.

PARAGRAPHS.

Siamese Revenue Cruiser "Suriya Monthon."—The Siamese revenue cruiser *Survia Monthon*, built to the order of the Siamese Government, under the supervision of Sir Wm. H. White, K.C.B., was successfully launched on Wednesday, March 18th, at the Southampton works of Messrs. John I. Thornycroft & Co., Ltd., by which firm the design and construction of the hull and machinery have been carried out. The naming ceremony was performed by the Siamese Chargé d'Affaires (the nobleman Luang Sanpakitch), representing His Majesty King Chulalongkorn. There were also present Mr. C. J. Ripet-Carnac, the Siamese Financial Agent, and several Siamese gentlemen. This vessel, the contract speed of which is 14½ knots, is destined for the service of the Siamese Customs and is similar in construction to the *Amapa*, recently built at the same works and sent out under her own power to Brazil for the Brazilian Customs service. The dimensions of the vessel are:—Length overall, 137 ft.; beam, 18 ft.; depth, 9 ft. 9 in.; draught, 6 ft. She carries on her forecastle one 6-pounder Hotchkiss quick-firing gun. The officers' quarters are situated under a raised quarter-deck aft, and consist of dining saloon and cabins for captain and six officers, bath, pantry, w.c., etc., being provided. The warrant officers' quarters and crew space are placed under forecastle forward. Ventilation, by means of electric fans, has been devised, with the object of making life more comfortable 'tween decks in all seasons. A small cold-storage cubicle has been provided. The vessel is provided with electric light throughout, and a searchlight projector of 10,000 candle power is placed on the bridge. A steam steering engine, controlled from the bridge, is situated over the after-end of the engine-room, the power being transmitted to the rudder by means of shafting and screw gear at the stern. A hand-steering wheel, placed aft, is also provided. A steam-windlass is fitted forward for working the cables, etc. The vessel is fitted with fourteen bulkheads—giving thirteen water-tight compartments—and only the second (collision) bulkhead is pierced by a water-tight door, the other bulkheads being intact. The forward and after-decks are also water-tight, so that grounding on coral uncharted reefs may only give local damage without danger of foundering. The machinery consists of two sets of tri-compound surface condensing engines, and one "Thornycroft" W.T. boiler, working under forced draught. The two condensers have separate circulating pumps. An evaporator, by Caird & Rayner, capable of supplying two and a half tons of fresh water in twenty-four hours, and also a drinking water distiller are provided. There are three steam pumps for feed, bilge and fire purposes. The cylinders are 9 in., 13 in. and 20½ in. diam., and the stroke is 11 in. Revolutions per minute, 375; working pressure 210. The vessel will no doubt soon influence the finances of Siam, being intended to suppress opium and other smuggling—such as firearms—on which there are heavy duties, though Siam is practically a free-trade country. The Siamese have always been a seafaring nation. The advent of the early Europeans to the Eastern seas gave proof of this. Thus, some 250 years ago, when one European Power made forcible seizure of the island of Junk Seylon, the King of Siam ordered "immediate building of six warships, each carrying ten guns with pattaroes, and well manned and fitted with small arms." These were built in one month, and this emergency mobilization with fighting orders was all rigidly obeyed under no less a penalty than decapitation and forfeiting of estates. On the official trial, which was carried out on March 28th, in the presence of Sir Wm. H. White, K.C.B. a speed of 14¾ knots was attained.

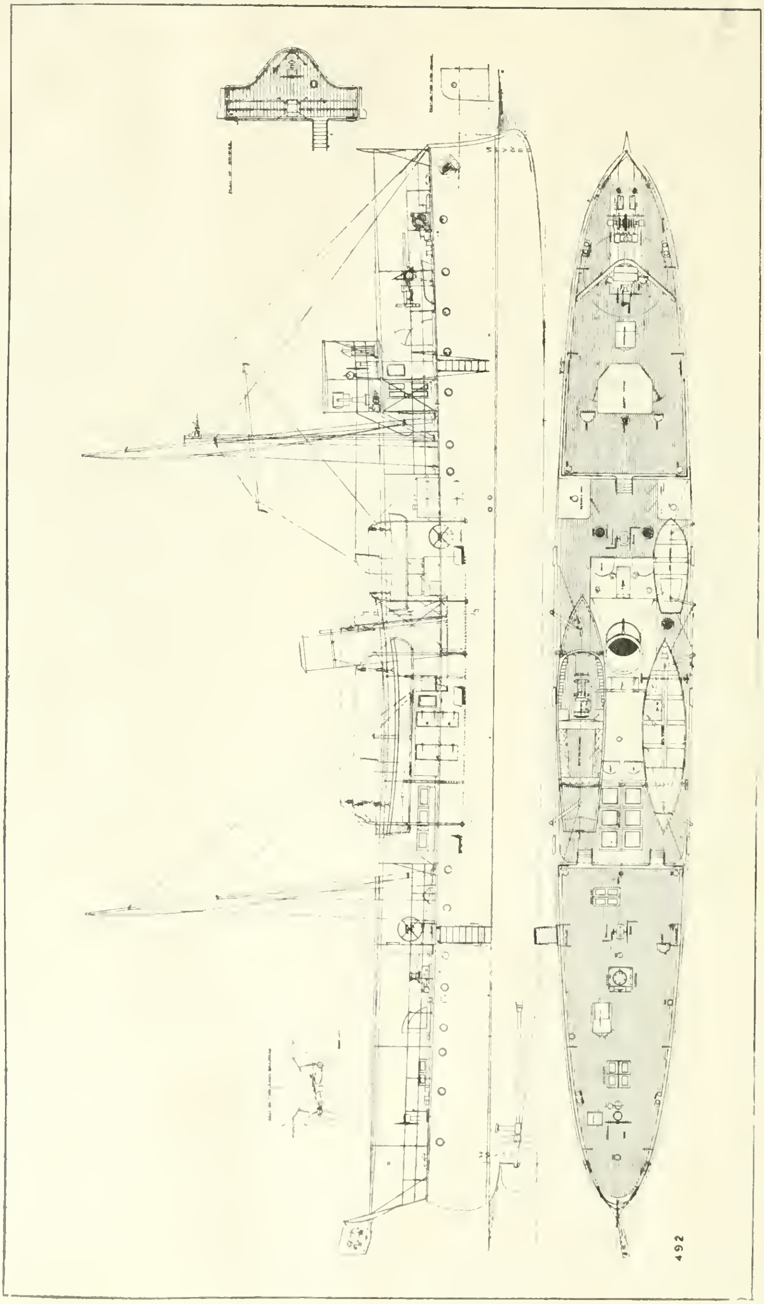
Scottish National Exhibition, Edinburgh.—The Scottish National Exhibition at Saughton Park, Edinburgh, which will be ceremonially opened by Prince Arthur of Connaught on May 1st, although nominally restricted to matters Scottish, will be representative to some extent of affairs international, and will certainly partake more of the educational character than of the general bazaar and popular entertainment order of shows of which this country, and even Scotland itself, has had plethora within recent years. The progress of industry, science and the fine arts will be worthily reflected in the show. The site of the Exhibition is within easy access of the centre of the Scottish Metropolis, and has been laid out on an area of fifty acres, or double the space taken up by the successful Exhibition of 1886, on the Meadows, nearer the centre of the city. At the time of writing, the buildings are in an almost completed state, and there is every likelihood that the state of affairs on the opening day will be approximately that of a well-finished display which has so often been far from true in undertakings of the kind.

The principal buildings proper of the Exhibition consist of an Industrial Hall, a Machinery Hall, a Hall of Fine Arts and a Concert Hall. The Industrial Hall covers an area of fully two and a half acres. The entire framing of the building is of timber, with fibre plaster on outer walls, and galvanised corrugated iron on roofs. The width of the building is 450 feet, and the breadth 220 feet, with wing portions extending to 250 feet in width. The floor space is 100,000 square feet in area. The Machinery Hall, originally intended to cover 20,000 square feet of area, was extended owing to the increased demand for space and now has an area of 31,400 feet. The building consists of two longitudinal and one central transverse bay, the construction and materials being generally the same as used in the Industrial Hall. The Concert Hall covers an area of 16,400 square feet and is seated for 2,000 people. The central portion containing the hall proper is circular in form, 100 feet diameter, with a domed roof, whose apex is 62 feet from ground level, the inside distance from floor to ceiling being 40 feet. Surrounding this circular main portion is a one-storey portion, containing choir and band rooms, crush halls, etc. This building is one of the finest pieces of architecture in the Exhibition, is seated for 2,000 people, and contains a large three-manual electric organ at the back of a spacious platform. The Fine Art section covers an area of close on 29,000 square feet and consists of nine galleries, having a total wall space of 2,000 lineal feet. In view of the valuable nature of the exhibits the whole of this building has been constructed with every regard to preserving its contents in the case of any outbreak of fire.

The placing of exhibits has been proceeding for a month past and stalls everywhere are rapidly taking form. They are most advanced in the Palace of Industries, which is the Cosmopolitan section of the show. The Japanese, with their characteristic promptitude, are the first in the field and their stalls are well forward. Italians, Dutch and representatives of other nationalities are energetically getting their stalls into order. In the Machinery Hall, the erection of machinery and of the plant for providing motive power are matters well advanced. In this section, of course, Glasgow and the West of Scotland contribute largely to the display. Some fine machines will be seen here in operation illustrative of "the Second City" in the engineering world. Edinburgh and other Scottish towns are well represented, the former by elaborate printing machines, biscuit and sweet-making machines, and others. The collection of machinery, in short, promises to be one of the most varied and interesting kind, and it goes without saying that shipbuilding, marine engineering, electrical engineering and all the co-related branches implied in the iron and steel industries will have their part in the display.

In the old mansion house of Saughton Hall, an artisan section has been arranged, and it has aroused the greatest interest amongst workers all over Scotland. Glasgow, in particular, will be well represented by exhibits including working models of engines, stationary models of battleships, and of course, one of the Clyde's finest productions in the way of ocean liners, the turbine Cunarder *Lusitania*.

In the matter of the decorative laying out of the grounds, of course, and of features for the entertainment of visitors, the Exhibition will be fully up-to-date. There is a fine winter garden, constructed almost wholly of iron and glass, and intended to be a permanent structure memorializing the Exhibition. An outstanding attraction will be the Senegalese native village, a tribe of 120 men, women and children having been brought over from West Africa to inhabit it and display their skill of hand and their habits of domestic life generally. Another feature of interest will be the model garden city planned on the Letchworth system, and, as a guarantee that this will prove a faithful model, it may be mentioned that the energetic manager of the Exhibition, Mr. Knight, before taking up his present duties, was a resident of that colony and held many posts in its administration. Other forms of amusement, too numerous to mention, are provided, and, of course, athletic sports will form sources of attraction for the multitude, for which purpose a splendid racing track and other essentials are provided.



General Arrangement of Customs' Cruiser, built by Messrs. John I. Thornycroft & Co., Ltd., to the order of the Siamese Government.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

The principal topic of conversation at this port during the past month has been the lamentable disaster to the destroyer *Tiger*, by which that unfortunate vessel was cut in half and her commander and thirty-four of her crew were lost. The battleship *Prince George* (flagship of Rear-Admiral Farquhar) and the cruisers *Argonaut*, *Gladiator*, *Berwick* and *Essex* left here on April 2nd for exercises, a flotilla of destroyers, including the *Tiger*, leaving the same day. During night operations, which were carried out with lights screened, the destroyer endeavoured to cross the bows of the *Berwick*, with the disastrous result above mentioned. To the promptness of Engineer-Lieutenant Venning and the discipline of all many of the crew undoubtedly owe their lives. The Engineer-Lieutenant and almost all the survivors were left on the after-part of the vessel, which remained afloat after the fore-part had capsized, and it speaks well for naval training that the men behaved, to use the words of a witness, "as coolly as if they were at a regatta." The court martial was held on board the *Victory* on April 10th and 11th, the result being that it was found that no person could be blamed for the lamentable affair. Memorial services were held at the Royal Naval Barracks Church, the Dockyard Church and on Whale Island on April 12th. The Mayor has opened a fund for the benefit of the relatives, to which the Queen has subscribed £100. The day the court martial closed the Lords of the Admiralty began their official inspection of the port. Disembarking from the Admiralty yacht *Enchantress*, they were received with the usual honours, and they then proceeded to inspect the Royal Marine Artillery at Eastney, the usual dinner being given in the evening. The following day being Sunday, nothing was done. On Monday, the 13th, the various naval establishments were visited, and in the evening the Admiral-Superintendent and the principal officers of the yard were entertained to dinner on board the yacht. The dockyard was visited the next day and after the site of the new lock had been inspected their lordships returned to London. The *Enchantress*, with Lord Tweedmouth on board, proceeded to Dartmouth, where the First Lord inspected the Naval College and took the opportunity in presenting the prizes to explain why he was leaving the Admiralty. His Lordship had arranged to visit Gibraltar in the yacht, but in consequence of the ministerial changes, by which he is succeeded in office by Mr. Reginald McKenna, the visit has been abandoned. It is understood that the work of constructing the new lock is to be expedited, but if so, more money will have to be allotted for the work during the financial year. Good progress is being made with the construction of the battleship *St. Vincent*, considerably more than 3,000 tons of material having been worked into the hull. The stern post was got into position about the middle of April by the staff of the manager of the constructive department. It is in one casting, weighing nearly twenty tons, and was fixed in about a quarter of an hour, which is generally acknowledged to be a particularly smart piece of work. With regard to the *Bellerophon*, there has been some delay in getting on with her rapidly, owing to the non-delivery of gun mountings, the firms who are making them having such a heavy pressure of work. Otherwise the vessel is well forward. Her turbines are in and her funnels and tripod masts up, while most of her armour has been fitted. It is anticipated that the vessel will be out of hand by the autumn, and that by the end of the year the new battleship will be laid down. Almost all the destroyers have had their defects made good, or have undergone thorough overhaul, and nearly all the smaller docks are now empty. The *Fawn*, which was damaged through striking on the rocks off the Scotch coast last autumn, and the *Kangaroo* are still in hand. The latter, however, is quite ready, with the exception of a capstan, which has not arrived, owing to the trade disputes in the north. It has been decided to remove the destroyers with nucleus crews to Southampton Water and notice to that effect has been sent to the Southampton Harbour Board. Pending the laying down of moorings in the Hamble river the vessels are to lie off Netley. The special service vessels are also to move from the harbour and are to remain in Stokes Bay during the construction of the new lock. The *Exe*, *Erne*, *Ness* and *Nith*, of the Eastern Destroyer Flotilla at Harwich, left on April 10th, after a week's stay, during which they were fitted with wireless telegraphy installations. The *Cheerful*, *Dee*, *Ure*, *Wear*, *Ettrick*, *Swale*, *Welland*, *Garry*, *Teviot* and *Ribble*, of the same flotilla, are also to be sent here to be similarly fitted. The work is being done by the staff of the torpedo depot ship *Vernon*. The battleship *Canopus*, which is now undergoing refit is to be ready by April 28th, as she is to go to the Mediterranean to relieve the *Formidable*. Another battleship in hand is the *Jupiter*, which, on her return from Dover at the end of March, was placed in No. 14 dock to have her defects remedied. The surveying vessel *Research*, which had been laid up for the winter months, left on April 16th to resume her duties on the coast of Scotland.

Devonport Dockyard.

The new Admiral-Superintendent, Rear-Admiral Cross, hoisted his flag on the last day of March in the battleship *Hannibal*, transferring it on the following morning to the dockyard flagstaff. A couple of days before Vice-Admiral Barlow relinquished his appointment as Superintendent he was entertained to a farewell dinner by the principal officers serving at the dockyard, Captain Ommanney presiding. The Admiral on leaving for Southsea, where he is now residing, had a most hearty send-off. In a minute issued with general orders, the late Superintendent, who had previously thanked the principal and superior officers, said he desired to give expression to his recognition of the valuable services rendered by the subordinate officers, draughtsmen, writers, chargemen and recorders, in promoting the efficiency of the yard during the period of his superintendence. There has been another change, Admiral Sir Lewis Beaumont, the Commander-in-Chief, having been succeeded on April 9th by Vice-Admiral Sir Wilmot Fawkes. The *Téméraire* now looks quite shipshape. Her tripod masts and two funnels have been fitted and two sets of turbine engines placed on board and connected up to their respective shafts. The other pair of engines are daily expected, and owing to the advanced state of the engine-room fittings they will be able to be got on board as soon as they arrive. With the barbette equipment good progress is also being made. The planking and caulking of the quarter deck is finished and the torpedo defence boom fittings are being fixed on the vessel's side. The weight of material now worked into the hull of the battleship *Collingwood* is about 3,000 tons. This is considered very satisfactory and is without doubt due to the large use made of pneumatic tools, of which we have now more than seventy at work. The battleship *Russell*, which was recommissioned at this port two years ago for service in the Atlantic Fleet, arrived from Gibraltar on April 13th for a refit. The battleship *Vengeance*, of the Channel Fleet, which is to come here to pay off on May 4th, is to go on to Portsmouth to join the Home Fleet at that port. The cruiser *Leviathan* arrived from Sheerness on April 8th, to take up her duties as flagship of Rear-Admiral Denison. The old flagship, the *Niobe*, was to be recommissioned as a special service vessel, but it has now been arranged that she is to be taken in hand for a refit. The ships of the local division of the Home Fleet went out to meet the battleship *Dreadnought* and returned to port in company with that vessel on April 10th. Some very interesting and instructive exercises were carried out in the Channel, including an attack on Sir Francis Bridgeman's flagship. With regard to small craft, the destroyer *Leopard*, which is having her boilers retubed, is to go on to Portsmouth when completed. Another destroyer is also to go on to that port—the *Fervent*, which has been refitted by the cadets at the Royal Naval Engineering College.

Chatham Dockyard.

The Lords of the Admiralty arrived for their annual visit on the evening of April 1st, and embarked in the yacht *Enchantress*, which was lying off the *Thunderbolt*. The proceedings opened, as is customary, with the dinner to the principal officers, at which the Commander-in-Chief at the Nore (Admiral Sir Gerard Noel) was the chief guest. Next morning the party, which consisted of Lord Tweedmouth, Vice-Admiral Sir William May, Rear-Admiral Winsloe, Mr. George Lambert, Mr. Edmund Robertson and Sir Charles

Inigo Thomas, received the flag officers, who were presented by Admiral Noel, and the officers of the yard, who were presented by Vice-Admiral Giffard. Mr. J. B. Marshall, C.B., Director of Dockyards, then joined the party. Subsequently their lordships visited the barracks and the hospitals and during the afternoon received deputations from a large number of workmen with reference to grievances. In the evening Vice-Admiral Giffard was the guest of the Admiralty Lords on board the yacht. On the 3rd, their Lordships went over the yard, visiting the submarines in course of construction, the *Shannon*, and several of the docks and workshops. The inspection, which their Lordships stated to be satisfactory in every respect, was concluded early in the afternoon, after which the party proceeded to Sheerness. The battleship *Ocean*, which arrived towards the end of March from the Channel Fleet, is undergoing a refit, after which she will be recommissioned for service in the Mediterranean. She was here during the early part of last year for some time undergoing repairs. Another battleship of the Channel Fleet, the *Dominion*, arrived on April 6th for her annual refit, which is expected to occupy about two months. The vessel has been serving with the Channel Fleet since the damage she sustained through grounding in Canadian waters was made good here. The cruiser *Vindictive*, which is refitting is to be out of dockyard hands on May 23rd. The armoured cruiser *Sutlej*, which has been undergoing a thorough refit since paying off from the Fourth Cruiser Squadron, will be out of hand very shortly. One of the most interesting lots in the annual dockyard sale was the old hulk *Asia*, which for many years did duty at Portsmouth. She was built at Bombay eighty-four years ago and did good service at the battle of Navarino. Seeing that she is built of teak, copper fastened and copper sheathed, Mr. Merville, of Dunkirk, may be considered to have acquired somewhat of a bargain for the £6,025 which he paid for the hulk. The timber will probably be used for making furniture.

Sheerness Dockyard.

On the afternoon of April 3rd, the Lords of the Admiralty came on in the *Enchantress* from Chatham for their inspection. The First Lord and his colleagues inspected the yard and Gunnery School next day. Some of the party went on board the *Cossack*, the first of the new ocean-going destroyers to commission and the fastest vessel flying the white ensign, the inspection concluding with a tour of the storehouses and a visit to the model room. Vice-Admiral Sir William May returned to London by rail, Lord Tweedmouth and the others leaving in the *Enchantress* at noon for Dover. There their Lordships inspected the southern breakwater and the Admiralty Pier extension. "My Lords" have expressed their satisfaction with what they saw while they were here. At the time of writing, the battleship *Dreadnought* has not yet returned from her cruise, being due on April 28th. I hear that the vessel has accomplished a splendid steaming performance. Leaving Rosyth on April 3rd, she steamed at an average of 20·5 knots against the tide for twelve consecutive hours, this being only half a knot less than her designed speed. The engines were then eased down for a coal consumption trial, which could not be completed in consequence of the vessel stopping to assist in rescuing the crew of a French schooner which went ashore on the Kentish Knock. It is stated that the engineer officers of the *Dreadnought* have discovered an important combination of power production in connection with the turbines, the effect of which is to considerably augment their power and to relatively increase the speed for the power exerted. The exact nature of the discovery is, of course, being kept a secret by the Admiralty officials to whom it has been communicated. The torpedo gunboat *Leda*, which had been in dockyard hands making good the damage received in collision with the cruiser *Andromache* in the River Stour, left at the end of March for Harwich to resume her duties under the Admiral commanding the Coastguard and Reserves. Another torpedo gunboat, the *Speedwell*, is having an extensive refit, which is not expected to be completed until June. Her funnels have been lifted out and her boilers are being retubed. The torpedo gunboat *Speedy* is also in dry dock. The destroyers *Sprightly* and *Charger* have been put in hand for an extensive refit, the former having been detached from the Eastern Flotilla for reboilering. The destroyer *Myrmidon*, which came from Portsmouth some months ago for refit, is now out of hand. She has had her boilers retubed and her hull and machinery overhauled. The 27-knot destroyer *Wizard* has been dry docked for a survey to ascertain if she is worth the cost of a thorough refit. Built by White & Co., of Cowes, she hoisted the pennant for the first time in July, 1900. The *Charger*, another of the earlier destroyers, is in hand for a general refit, which is to include the retubing of her water tube boilers. Submarines C1 and C6 have completed their refits and rejoined the flotilla. C3 and C4 are in dry dock undergoing an overhaul before going to Harwich, which is now the headquarters of the flotilla. The destroyer *Afridi* came here some time ago from the Tyne for her steam and gun mounting trials and was berthed at a buoy off Port Victoria awaiting the termination of the labour troubles. She has now been taken up the Medway and placed in the steam basin at Chatham, where she is to remain pending a settlement of the strike. The Admiralty have purchased two passenger steamers, the *Roslin Castle* and the *Lady Margaret*, for service in the Medway in landing and embarking liberty men of the Home Fleet. The former, which was built at Leith two years ago, is a screw saloon steamer, 185 feet in length, and has hitherto been employed by the Galloway Steamboat Co. The *Lady Margaret*, which is 210 feet long, is a paddle boat, and was built at Dumbarton thirteen years ago. She has been in the service of the Furness Railway Company at Barrow.

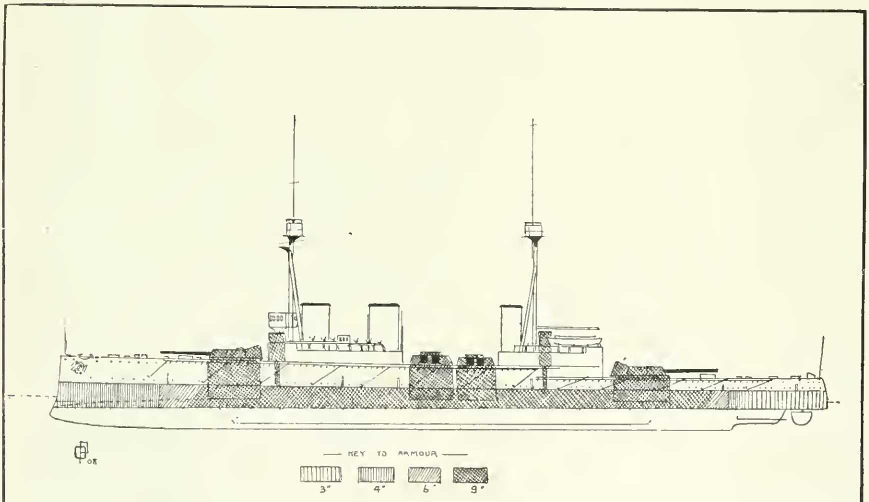
Pembroke Dockyard.

We have not yet heard who is to perform the ceremony of launching the cruiser *Boadicea* on May 14th. The launching cradle is employing over forty shipwrights and apprentices, who are all on piecework, this being the first occasion for some years that such work has been done on piece rates. It is to the men's advantage to be so employed, for they earn considerably more than when paid by the day. Boring operations in the tubes and brackets on the port side of the *Boadicea* were commenced on the last day of March and have been pressed on continuously by night and day shifts. The vessel will have four propeller shafts, and the engineers, in order to expedite matters, have been boring throughout for two simultaneously. The rudder, which weighs between seven and eight tons, was placed in position during the first week in April. The first consignment of material for our new vessel arrived at the beginning of the month. She is to be laid down in No. 5 slip after the launch of the *Boadicea*, and the vessel will, it is anticipated, be pushed on with more than usual expedition. Indeed, it is stated that an attempt will be made to create a local record both in respect of cost and rapid construction. It is still uncertain when the *Defence* will leave for her steam trials, although June 3rd was the date named some time ago. Her electrical installation is in a somewhat backward state owing in some measure to the delay which has occurred in the delivery of fittings from the contractors, and may not be sufficiently advanced to permit of the vessel's trials until a month or so later. The delay in the delivery of the electric capstan is due to the engineers' strike in the North. At the end of March the steamship *Argo* came in for some small alterations to adapt her for surveying duties, upon which she has since entered. She is a private yacht about twenty years old and has been hired to replace the *Gladiator* as surveying vessel on the West Coast. The new programme shows that it is proposed to employ 2,030 men at the yard during the financial year. This is an increase of forty-five on last year, but only an additional £700 is allowed for the increase.

Freight Barge.—The large ocean-going freight barge built for the Anglo-American Oil Co. has made a voyage across the Atlantic and back in tow of one of the oil-carrying-steamers of this Company's fleet, each having on board about 9000 tons of oil on the return run. The time occupied on this run with the cargo on board has been about fifteen days, and the towage of the barge appears to have involved a drop in the speed of the towing steamer of about 35 miles per day with an expenditure of about 15 to 20 per cent. more coal. It may be premised from the apparent success which has crowned the venture that we may congratulate the Company on their enterprise.

H.M.S. "INVINCIBLE."

The *Invincible* and her sisters *Indomitable* and *Inflexible* are now completing for sea preparatory to joining the Nore command, which they are due to do this month (May), although some delay with the *Invincible* has resulted through the labour disputes in the North. All three ships were laid down in 1906 and launched the next year, the *Invincible* at Elswick, the *Indomitable* at Fairfield and the *Inflexible* at Clydebank. The same secrecy which was observed during the building of the *Dreadnought* has characterized the construction of these ships; at their inception they were officially designated "armoured cruisers," and for a long time it was generally understood that their armament would consist of 9·2" guns, the design of the ship being some natural evolution of the *Shannon's* Unfortunately the exact nature of the trio leaked out even before they were launched—in contra-distinction to the new German ships which are all still more or less of mysteries—and it was then seen that they were simply *Dreadnoughts* with somewhat reduced defensive powers and minus two 12" guns, but designed for the unique speed of 25 knots, which is expected to reach 27 on trial. In consequence, the service papers have been full of criticisms for and against the type as the writers attributed to them the rôles of battleship, cruiser pure and simple or scout. Their cost, some £1,730,000 odd, was said to militate against their multiplication as cruisers, and their protection to debar their use as "line ships"; in brief, their real functions were completely overlooked, and a census of opinion seemed to consider *Dreadnoughts* or smaller cruisers as better value for the money. As a matter of fact, these three ships will have to perform one of the most difficult duties of modern warfare, that of being detached to overtake, hang on to the flanks of the enemy and keep him in action until the main fleet can come up. Now that all the Powers are giving their battleships speeds of 19 knots and over, it would mean that the *Dreadnoughts* would have as much difficulty in bringing them to action as Sir Arthur Wilson had with Admiral May's squadron of *King Edwards* in the 1906 manœuvres. The *Invincibles*, however, could romp on ahead and by reason of their being able to keep outside the range of any gun under the 12", could inflict sufficient damage on individual units to impair the speed of the squadron. Our smaller "armoured cruisers" could not do this without grave danger of being sunk before their aim was accomplished—with their 9·2" and 7·5" guns they would perforce have to come into range of the 11" and 9·4" batteries opposing them. The *Invincibles* are essentially "line ships," with the additional métier of commerce protection, inasmuch as they could be despatched individually to hunt down some powerful cruiser that was harrying shipping, once her whereabouts had become ascertained by the patrol ships that were incapable of bringing her to grips. In the future it will be possible for "wireless" to keep outlying ships in full communication with the flag and have the faster "battleship-cruisers" despatched should a heavy striking force be required to tackle such ships as the new German *Blucher* or the



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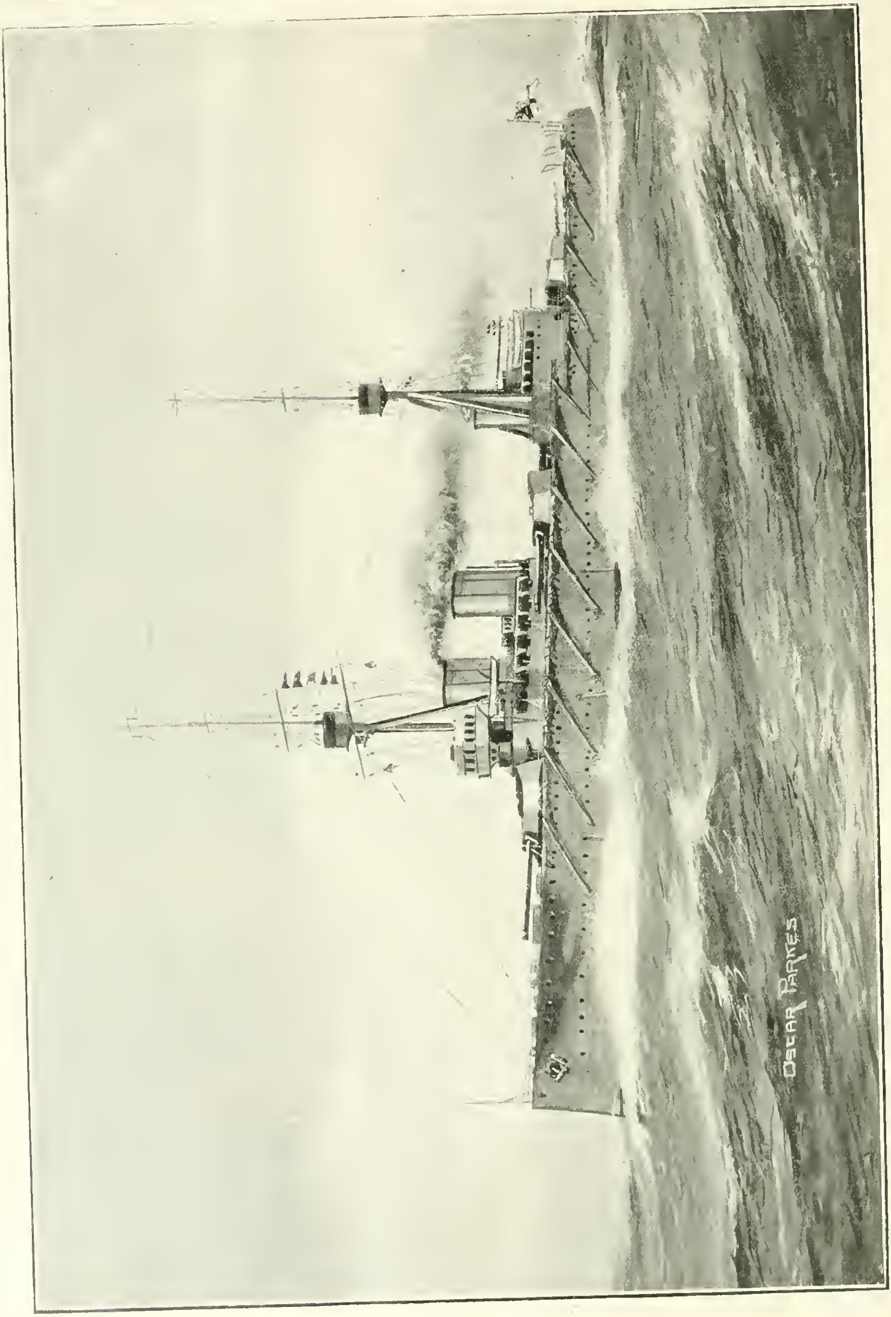


H.M.S. "Invincible."

Russian *Rurik*, which the smaller fry such as the "County class" could hang on the tail of until such reinforcements arrived. In design the *Invincible* is unique, the disposition of her guns being a hark-back to the days of the *Colossus* and *Lepanto*. All the 8·12" guns can be fired on either broadside, and except that the two off-side guns have a limited arc of fire when fired over the opposite beam, the discharge would be the same as the *Dreadnought*: ahead and astern both ships are equally matched. The *Invincible* carries a heavier anti-torpedo than the *Dreadnought*, a new 4" weapon firing a 31 lb. projectile, against the latter's 18 pounders. Sixteen of these are mounted in the superstructure. Although protection has been sacrificed to some extent for the gain in speed, the complete waterline belt, varying in thickness from 9-4 inches, gives her a better defence than our older battleships. The general internal arrangements of the bulkheads and barbette isolation is similiar to the *Dreadnought* except that the ship contains practically four individual forts instead of five. In view of this coalition of ideal fighting qualities, it was inevitable that the dimensions should exceed those of any other ship afloat, and with a length of 530 feet and beam of 78½ feet and draught of 26 feet the *Invincible* will have a nominal displacement of 17,250 tons—practically only 650 tons less than the *Dreadnought*, although she is 40 feet longer than that ship. In appearance she suggests all her power and speed. Her huge freeboard, running three-quarters of the length of ship, enables 6 of the 8 guns to have a command of over 28 feet, the after pair being carried on the main deck. The funnels vary in size, those forward being excessively wide when viewed abeam and narrow at the ends, while the third is rounder and thinner. Both masts have a square control platform supported by tripod legs, that forward has a search-light platform. The torpedo net defence is on two separate shelves, having 8 booms and 5 booms respectively, the break in the tap-side precluding a continuous shelf. Three submerged torpedo-tubes are carried, but whether for any larger sized torpedo than the 18" is uncertain.

The fourth ship of the class has been provided for under the current estimates; she will be of the same design, but with certain improvements suggested by the trials of the *Dreadnought* and possibly may be modified should the *Invincible* exhibit any marked justifications, which is unlikely. The advent of the internal combustion engine for marine propulsion will as likely as not influence following types.

MESSRS. WILLIAM HAMILTON & Co., shipbuilders, Port Glasgow, have obtained from the patentee, Mr. J. W. Isherwood, of Messrs. R. Craggs & Sons, Ltd., Middlesbrough, the first licence for constructing steamers on the longitudinal system, as carried out in the case of a steamer recently built by Messrs. Craggs and as described by the patentee before the recent meeting of the Institution of Naval Architects.

A NEW SYSTEM OF SHIP CONSTRUCTION.*

By J. W. ISHERWOOD, Esq.

OF late years considerable advance has been made in ship construction. Lower tiers of beams and decks have been dispensed with that were not long ago considered essential for structural strength. New types of vessels, such as the turret steamers of Messrs. Doxford, trunk steamers of Messrs. Ropner, and cantilever frame vessels of Messrs. Dixon, have also been built and proved to be successful, both structurally and commercially, yet the fundamental principles on which these and ordinary vessels are now being constructed are the same as were adopted in the earliest days of sea-going vessels.

So far all merchant vessels have been built with closely spaced transverse frames and closely spaced transverse beams, with the exception of one or two vessels built by Scott Russell in the sixties with longitudinal framing, full particulars of which will be found in Scott Russell's works. The *Great Eastern*, built on the box unit system, was, of course, the most notable example, and, being so well known, it is unnecessary to analyse the structure for the purposes of this paper. The difficulty and cost of erection were probably such as to prevent the system being generally adopted.

Naval architects have for so long recognised the great increase in strength obtained by framing a vessel longitudinally, that it is a matter for wonder that some practicable system of longitudinal framing has not been arrived at, or hitherto suggested, the advantages being so clear and so desirable.

In the new method of construction with which my name is associated, the closely spaced transverse frames and closely spaced transverse beams, with which we are so familiar, are omitted. The transverse strength of the vessel is obtained by fitting directly on the plating a series of strong transverse girder frames and beams at widely spaced intervals, or where transverse bulkheads are fitted for the purpose of sub-division, as in oil steamers, for instance, they take the place of such transverses, but it is not essential that bulkheads should be fitted for obtaining the requisite structural strength. The transverse structures, which extend, where practicable, completely round the vessel, are of sufficient strength to withstand the whole collective water pressure on the skin of the vessel, and the upper portions forming the transverse beams are of such strength as to be able to carry the same collective weight on the deck as the greater number of transverse beams fitted in vessels of the ordinary construction.

It will be observed, from the diagrams, that the transverses are in all cases directly attached to the shell plating and deck of the vessel, and this is of the utmost importance, as it enables the shell plating and deck plating, with the efficient longitudinal support which will be described later, to be considered as part of the transverse girder when calculating the comparative stresses.

The transverse thrust is also borne in mind when determining the arrangement and scantlings of the materials forming the transverse girder beams.

Having now briefly indicated how the main transverse strength of the vessel is provided, the arrangement of longitudinal stiffening is next to be considered. The shell plating and deck between the transverses are supported by continuous longitudinals, the transverses being slotted to admit of the longitudinals passing through them. The longitudinals are dealt with as girders having a length corresponding to the interval between the strong transverses, and are of strength not less than that of transverse frames of vessels of the ordinary construction, the comparative stresses being taken for each calculation under the same conditions as to water pressure, etc.

The longitudinal beams are similarly considered, but a deck load is taken as a basis; those at the uppermost deck are increased beyond the size required to give a corresponding stress on ordinary transverse beams on account of the longitudinals being also subject to longitudinal bending strains.

* Read at the Spring Meetings of the Forty-ninth Session of the Institution of Naval Architects, April, 9, 1908.

Whether this increase is necessary or not in considering material of stiffening which is not already unduly stressed, and which at the same time is relieving the plating, is a matter for discussion.

In vessels with double bottoms, the stiffening, whether in the nature of plates, angles or of sectional material, is also fitted longitudinally, but a transverse floor is fitted in line with the side transverses, and where the spacing of the transverses is great, an intermediate transverse floor, either intercostal or continuous, should be fitted in the bottom in order to provide for sufficient transverse strength for docking purposes and to efficiently support the longitudinal stiffening in the bottom.

It will be apparent that the arrangement of material provides for increased longitudinal strength, and admits at the strong transverse beams. To obtain equivalent results in the ordinary transverse system, it would be necessary to greatly increase the strength of every transverse beam and the connecting knees.

The structure is simplified, all parts are easily accessible, and maintenance repairs are in consequence reduced, a feature that should be welcome to owners and their superintendents.

A vessel so constructed would not be so liable to be broached by collision. It will be obvious that before the sides could be pierced it would be necessary for the longitudinals to be fractured, whereas in the ordinary transverse framed vessel there are only the side stringers to give fore and aft support to the plating between the transverse frames, and there is a growing tendency to dispense with this support, and

Fig. 1

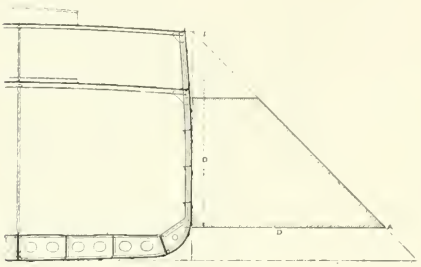


Fig. 2

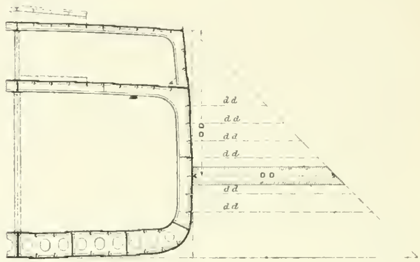
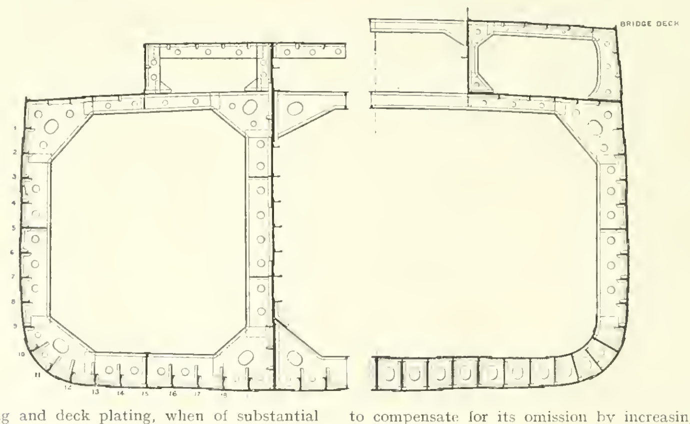


Fig. 3



of the shell plating and deck plating, when of substantial thickness, being reduced below the recognised standards of the various Classification Societies. It would appear that a vessel so constructed could safely withstand higher longitudinal stresses than a similar vessel framed in the ordinary manner, by reason of all the plating being supported in the direction in which the greatest stresses occur. This consideration is in strong contrast with that obtaining in the ordinary transverse framed vessel, where the deck plating especially is nearly devoid of the desirable longitudinal support. The fact of many vessels having buckled their decks between the beams proves that more efficient longitudinal support is necessary than is fitted in ordinary cases.

The new system adapts itself to a rearrangement of the pillaring of ships in such a way as to overcome a cause of serious obstruction in the holds, pillars being only required to compensate for its omission by increasing the thickness of the plating and by fitting transverse frames of increased rigidity.

The question of facility for carrying out damage repairs is an interesting one in considering a new system of ship construction. In the system under consideration such damage as would be caused by grounding or collision could be repaired more expeditiously than in ordinary vessels. In the event of damage to the bottom longitudinals, it would only be necessary to remove the plates in way of damage, and the longitudinals are at once accessible without removing the plating across the bottom as is necessary in a transverse framed vessel. Damage repairs through collision could also be effected with despatch on account of the simplification and accessibility of all parts of the structure.

It might be suggested that the deep transverses are a

source of obstruction, but the obstruction is not so great as would appear to be the case from a casual glance at the sketch of midship section. In ordinary cargo vessels, the transverses could be fitted from 12 ft. to 20 ft. apart, and there are no broad horizontal plate stringers with bracket supports as in a web-framed ship, nor would it be necessary to fit widely spaced strong hold beams with broad plate stringers, on the ends, such as are often fitted in deep single-deck ships framed in the usual manner.

It might here be explained, in regard to the spacing of the strong transverses in the new system, that the wider the spacing the heavier is the ship, owing to stronger longitudinals at the sides and deck being necessary. An economical spacing is found to be from 12 ft. to 16 ft., and there is practically no limit to the depth to which single-deck vessels, without hold beams, could be constructed. At the same time an important saving in weight of material, as compared with a transverse framed ship, would be effected.

It will be observed that limbers can be reduced to a minimum in the new type of vessel, that part being almost recovered for either water ballast or cargo, and between the transverses the space is quite clear of beam knees and tank-side knees.

Dr. Bruhn discussed methods of comparing transverse strength in an able paper recently read before the Institution, and it would unduly prolong this paper to give and discuss all the calculations that have been made. For the present it will probably be sufficient to show the principal bases which have been worked to, and to state the result of these calculations, for determining the main scantlings of an oil-carrying steamer now being built by my firm, Messrs. R. Craggs & Sons, Ltd., Middlesbrough, for Messrs. Lennard's Carrying Company, Ltd., a firm who have had considerable experience in managing and repairing steamers engaged in carrying oil in bulk.

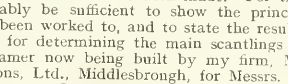
Fig. 1 is a midship section of an ordinary transverse-framed vessel.

For purposes of comparison, a strip of plating corresponding to a frame space is considered as part of the frame girder. The stress is then ascertained by assuming a water load on the frame girder shown by the line drawn from the gunwale to a point A, the distance D corresponding to the depth of the lower part of the frame girder below the gunwale. For convenience in calculation a mean load is assumed.

The figures obtained, without assuming any internal support from the cargo, might reasonably be taken as the stresses the frames are subject to under ordinary working conditions, the head of water assumed at the water line corresponding to the freeboard, and being a fair allowance for the increased pressure due to waves, etc.; in any case, the figures need only be used in a comparative sense, although investigations in many cases show the calculated stresses to be reasonable and such as allow of a fair margin of safety.

In considering a vessel with web frames, a strip of shell plating corresponding to a web-frame space is taken as part of the frame girder along with the ordinary transverse frames on this strip of plating—

thus



The load on the web frame is then taken over the web-frame space.

The results on this basis for web-frame ships generally show higher stresses than are found in the cases of vessels with either ordinary or deep frames.

For the beams comparison, one beam space of deck plating is taken as part of the beam girder and a load assumed on the deck, *viz.*, 6 ft. high at 50 cub. ft. per ton for upper decks, and the actual height of 'tween decks at 50 cub. ft. per ton for lower decks.

Fig. 2 is a midship section showing the new system of framing. The strong transverse frames are considered as loaded in a similar manner to the ordinary transverse frames, a strip of plating being taken as part of the transverse frame girder. Although plating corresponding to the spacing of the transverses might reasonably be taken as part of the girder in the new system, as allowed in the transverse system, only half this amount of plating has been so considered in the calculations for these structures in the oil vessel referred to.

In this vessel the depth of the transverses has also been increased beyond the equivalent arrived at by comparison with either a web frame or a deep transverse frame on the above basis. This has been done in order to reduce the shearing stresses on the rivets attaching the transverses to the shell plating, and the obstruction is no detriment when liquid cargo is carried. The longitudinals are similarly considered, the length of girder being taken as the distance between the transverses, and the head of water corresponding to the distance each longitudinal D D is below the gunwale.

In addition to calculating the comparative stresses for ordinary working conditions in the oil vessel, as before mentioned, calculations were also made to ascertain the stresses under Lloyd's Register test for oil-carrying vessels, *viz.*, with head of water 12 ft. above the deck. This is a severe test, and it is open to question whether it is not too great, possibly doing injury by subjecting the rivets to stresses which are much too high, having in view the duty to be taken in service.

The calculations for the deck beams, both transverse and longitudinal, are made in the same way, a strip of plating in each case being considered as part of the girder.

Messrs. Craggs & Sons and Messrs. Lennard's Carrying Company have kindly agreed to my publishing the principal scantlings and arrangements of this steamer, and the results of the principal calculations.

Fig. 3 shows the midship section; A, in way of oil tanks; B, in way of machinery spaces.

Fig. 4. Longitudinal section, showing position of bulkheads and arrangement of transverse materials.

Fig. 5. Expansion plan, showing arrangement of framing.

Fig. 6. Expansion plan, showing plate edges.

Fig. 7. Details showing bracket connections of longitudinal bulb angle frames and bottom girders to transverse bulkheads, and also attachments of longitudinals to transverses.

Fig. 8. Arrangement of transverse bulkhead stiffening.

Fig. 9. B^1, B^2, and B^3, details showing bracket connections at the transverse and longitudinal bulkheads and (A) of the deck longitudinals to the transverse bulkheads.

In addition to the vessel being constructed on the new system, the general design, for which Mr. E. Hall Craggs is responsible, differs in some respects from the ordinary oil-carrying vessel. The steamer is of the single-deck type, having a continuous expansion trunkway above the oil-tanks; quadruple-expansion engines are to be fitted amidships, and arrangements have been made for three main boilers to be fitted abreast.

The coaling arrangements are very simple and very little trimming is necessary, the cross bunker forward of the boiler-room (A in Fig. 4) being the main permanent bunker. The bridge space is to be utilized for reserve bunkers. A double bottom available for carrying oil fuel or water ballast is to be fitted in the machinery spaces.

In order to avoid any break in the longitudinal strength, the trunk is continued through the bridge, and it is interesting to note that the arrangements are such as to provide for practically the same longitudinal strength through the machinery spaces as in way of the oil tanks at each end of the bridge, the omission of the centre bulkhead being compensated for by the longitudinally stiffened bridge and double bottom. The tank abaft the engine-room is for carrying part cargo of refined spirit, and is fitted with a cofferdam at each end. The short tanks at the ends of the vessel (B, B, in Fig. 4) provide for taking a cargo of spirit when more capacity is required than for carrying heavy oils, or these tanks may, when required, be used as supplementary tanks for special uses.

The dimensions of the vessel are as follows:—Length bp., 355 ft.; breadth, extreme, 49 ft. 5 in.; depth at centre, 29 ft. The scantlings have been approved by three Classification Societies, *viz.*, Lloyd's Register of Shipping, Bureau Veritas and British Corporation, and the vessel is being constructed for the highest classification of each.

Transverses.—The main oil tanks are 30 ft. long, and two transverses are fitted in each of these tanks. The transverses are 35 in. deep at the side, 20 in. across the deck, 39 in. at the bottom, and 33 in. at the middle line bulkhead. They are formed of plates $\frac{9}{20}$ in. in thickness and are connected to the shell plating by double angles. Double-face angles are fitted 5 in. $\times$ 4 in. $\times \frac{10}{20}$ in. In the engine and boiler spaces, practically the same spacing of transverses is maintained.

In way of the double bottom the alternate transverses are fitted continuously around the bottom to the middle line, and the longitudinal girders are fitted in long lengths between these transverses, to which they are efficiently attached. The remaining transverses are stopped at the deep girder in the double bottom next the margin plate, and are then fitted intercostally between the longitudinals to the centre line. The margin plate is fitted intercostally between the transverses and connected to them by double-riveted water-tight collars.

Longitudinals.—The uppermost bulb angle below the upper deck (No. 1, in Fig. 3) is 8 in. × $3\frac{1}{2}$ in. × $\frac{8}{20}$ in. amidships, and is reduced to 7 in. × $3\frac{1}{2}$ in. × $\frac{8}{20}$ in. at the ends; the lowest bulb angle (No. 9) is $9\frac{1}{2}$ in. × $3\frac{1}{2}$ in. × $\frac{12}{20}$ in., and the intermediate bulb angles are graduated in size according to the depth of immersion. They are spaced 29 in. apart. The bottom longitudinals are 15 in. × $\frac{8-7}{20}$ in., graduating in depth to 12 in. × $\frac{8-7}{20}$ in. at upper turn of bilge; the angles at top and bottom of these girders are $3\frac{1}{2}$ in. × $3\frac{1}{2}$ in × $\frac{8}{20}$ in. The deck longitudinals are 7 in. × 3 in. × by $\frac{8}{20}$ in. amidships, except in way of the bridge, where they are $5\frac{1}{2}$ in. × 3 in. × $\frac{8}{20}$ in., and they are also this size at the ends of the vessel. They are spaced about 27 in. apart. As previously mentioned, the longitudinal materials at the upper and lower parts of the structure for about the midship half length are increased in strength beyond that required to resist the water pressure, on account of these parts being also subject to bending strains. The trunk deck longitudinals at sides of hatchways are 7 in. × 3 in. × $\frac{7}{20}$ in. bulb angles; those in between the hatchways are reduced to $5\frac{1}{2}$ in.

Fig. 4.

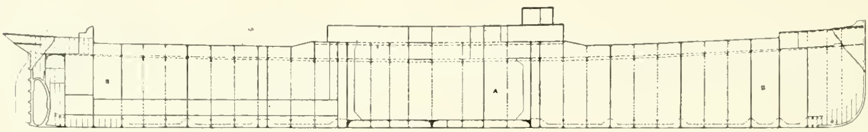


Fig. 5

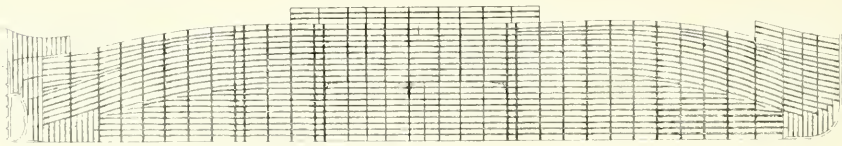


Fig. 6.

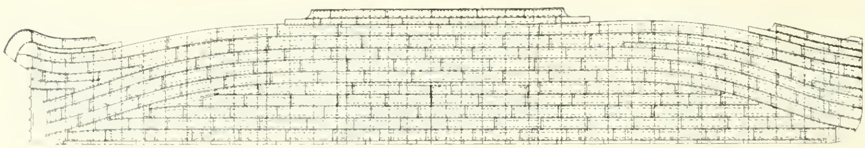
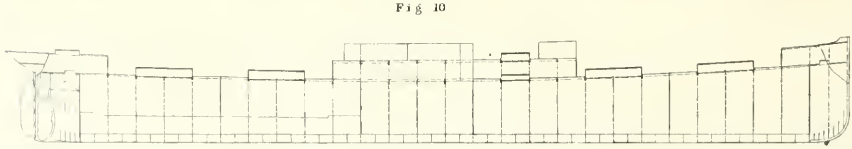


Fig 10



The upper deck and trunk sides are $\frac{10}{20}$ in. thick, the upper deck stringer plate is $\frac{12-9}{20}$ in. clear of bridge and $\frac{10}{20}$ in. in the bridge. The stringer plate at the bridge ends is $\frac{16}{20}$ in. thick. The trunk stringer plate and trunk deck centre plate are $\frac{10}{20}$ in. thickness. The sheer strake is $\frac{12}{20}$ in. in way of the bridge, $\frac{16}{20}$ in. at the bridge ends, and $\frac{9}{20}$ in. at the ends of the vessel; the side plating is $\frac{11}{20}$ in. to $\frac{9}{20}$ in., and $\frac{12}{20}$ in. to $\frac{9}{20}$ in. alternately, and the bottom plating is $\frac{13}{20}$ in. amidships, $\frac{9}{20}$ in. in fore peak, and $\frac{10}{20}$ in. aft. The bridge side strakes of plating are $\frac{9}{20}$ in. and $\frac{8}{20}$ in. respectively. Three strakes of plating at each side of the keel plate have their midship thicknesses maintained to the collision bulkhead and the flat of bottom from No. 4 bulkhead (numbering from forward) to the collision bulkhead is additionally strengthened by the fitting of double 6 in. ×6 in. angles to the transverses and double angles $3\frac{1}{2}$ in. × $3\frac{1}{2}$ in. to the longitudinals.

From the expansion plans it will be observed that the plate edges up to the strake below the sheer strake are parallel to the keel, and that the spacing of the longitudinals at the ends of the vessel does not exceed the midship spacing, but is in some parts closer than amidships. The longitudinals are also so arranged that the crossing of the plate edges is almost avoided. The uppermost longitudinal on middle line bulkhead in trunk is 7 in. × 3 in. × $\frac{7}{20}$ in. bulb angle, and the bottom longitudinal is $9\frac{1}{2}$ in. × $3\frac{1}{2}$ in. × $\frac{11}{20}$ in., the intermediate stiffeners being graduated in size.

The transverse bulkheads (Fig. 8), are supported on one side by three deep web plates A on each side of the middle line bulkhead, and on the opposite side with horizontal stiffeners in line with the longitudinals on side plating and the longitudinals on middle line bulkhead. The sizes of these

horizontal stiffeners are graduated according to their depth of immersion in a similar manner to those at the sides of the vessel, and on the middle line bulkhead.

The longitudinal frames and beams and longitudinal stiffeners on middle line bulkhead are cut at the transverse bulkheads, and are fitted with brackets efficiently connected to stiffeners and bulkheads in order to preserve the continuity of strength.

Reference might here be made to the attachments fitted to connect the side stringer plates and bottom side keelsons in oil vessels built on the ordinary transverse system. Preparatory to determining the scantlings for the vessel described, investigations were made with a view of ascertaining the stresses these connections are subject to under test conditions. This was found to be a complex problem on account of the arrangement of materials adopted. The web frames with their attachments to the shell plating, as usually fitted, are not in themselves of sufficient strength to withstand the whole collective pressure, the intermediate transverse frames are not of sufficient strength to admit of the side stringers being omitted, and it would therefore appear as though the side stringers, acting as girders between the transverse bulkheads, did the bulk of the work in supporting the transverse frames without obtaining the requisite support from the web frames.

If the side stringers in an oil steamer with ordinary framing and web frames are considered as girders between the transverse bulkheads, the stresses at the ends of the girders are found to be abnormally high, and such would appear to be the explanation for the serious troubles experienced in so many of these steamers at the bracket attachments to the transverse bulkheads. The investigation points to the necessity of further increasing the depth of the web frames in ordinary oil-carrying vessels, and also of fitting double-riveted attachments to the shell plating as prescribed by the rules of Bureau Veritas.

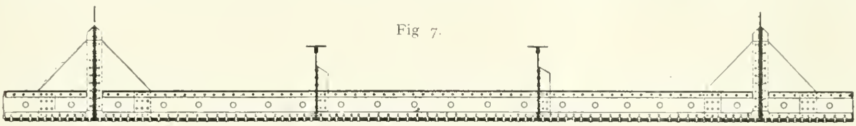
It is of interest to note, in the new rules of the British Corporation Registry for oil-carrying vessels, that this society has the courage to provide for "deep frame" construction in this type of vessel. Close investigation shows this to be distinctly preferable to the web-framed arrangements generally adopted, and this is confirmed by the experience gained in steamers having deep frames in deep water ballast tanks.

In the system of framing under consideration, it is a simple matter to single out and determine the stresses on all parts of the structure under test conditions. Under these conditions the rivets attaching the brackets to the transverse bulkheads are subject to stresses in no case exceeding $3\frac{1}{2}$ tons per square inch, which is only a fraction of that to which the stringer attachments in ordinary vessels are subject when considered under the same conditions. The strength of the rivet attachments in all parts of the structure in the new system have also been carefully investigated. The transverses are connected to the shell plating with double angles, having the rivets spaced about four and a half diameters apart. The rivets attaching the longitudinals to the shell plating are spaced six diameters apart, except in the vicinity of the transverses. The shearing stresses at these parts being at a maximum, a closer spacing has been adopted, *viz.*, from three and a half diameters to four and a half diameters, except at the uppermost longitudinals, where a uniform spacing of six diameters has been adopted.

It is a debatable point whether direct attachments of the longitudinals to the transverses are necessary, or whether the shell plating itself does not provide a gusset binding the two parts of the structure efficiently together. It would appear that if both longitudinals and transverses are efficiently riveted to the plating in the manner previously described no individual movement could take place.

In this oil-carrying steamer, however, and having in view the testing of tanks before the vessel is launched, it was decided to attach the bottom longitudinals to the transverses with vertical lugs having six rivets in each flange, the lower bulb angles with four rivets and the upper ones with two rivets. These attachments, whether structurally necessary or otherwise, were expected to facilitate the erection of the steamer, but in actual practice they proved of little importance. The transverses, where connected to the middle line bulkhead, are attached to the plating with single angles double riveted, and, as at the skin plating, the rivets are

Fig 7.



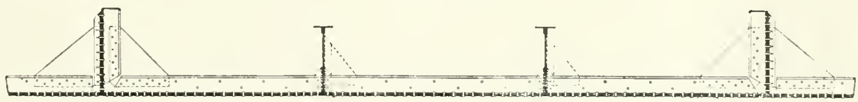
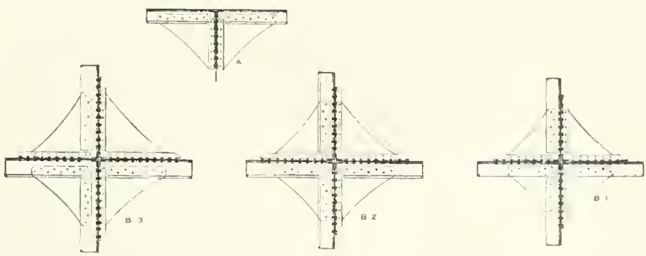


Fig 9



closer spaced in the horizontals in the vicinity of the transverses. The deep web plates on transverse bulkheads are attached with single angles having the rivets four and a half diameters apart, and a uniform spacing of five diameters is adopted for the lower horizontals and six diameters for the upper ones.

The comparative longitudinal stresses calculated under the usually accepted loaded conditions, *viz.*, by assuming the vessel on a wave of her own length and the bending moment as $\frac{D \times L}{35}$, show the tension at the bridge gunwale amidships to be $18\frac{1}{2}$ per cent. less in the vessel built on the new system, the results being as follows.

New system ...... 6·7 tons per square inch.
Ordinary system .. 8·22 ,, ,,

In making the comparison at the bridge ends, the bending moment was assumed $\frac{D \times L}{45}$ on account of these parts being some distance from amidships. (Whether the factor 45 is correct or otherwise is unimportant since it would not materially alter the comparison.) Under these conditions the comparative stress at top of trunk is 10·8 per cent. less in the new system, the results being as follows :—

New system ...... 6·61 tons per square inch.
Ordinary system .. 7·41 ,, ,,

The comparative transverse and deck stresses on the bases previously described are shown in the table. Although this comparison of stresses shows the structure to be of generally increased strength, yet there is a saving in weight of material estimated at 275 tons. The saving is due to the redistribution of material, which admits of dispensing with a large number of transverse connections. The vessel, in consequence, could carry 275 tons more deadweight on the same draught, with the same model and with the same consumption of fuel, thus considerably increasing the earning power of the steamer.

A few remarks as to the erection of the ship may be of interest. The keel plate was laid and middle line keelson fitted as usual. The after peak is framed with the usual transverse frames, and the erection up to the peak bulkhead was the same as in ordinary vessels. The peak bulkhead and the two transverse bulkheads forming the two short compartments aft were then put together on the ground, erected and secured in position, middle line bulkhead fitted, and longitudinals placed in position.

The two transverses in the next compartment were erected on the port side of the ship, circular tunnel built in, middle line bulkhead fitted, and transverses on starboard side then erected. The longitudinals at bottom and sides were lifted into position, and the next transverse bulkhead erected, and so closed up that tank. The same method of procedure was repeated for the remainder of the vessel. The erection of the forward part, where clear of tunnel, showed the simplicity of the system.

The brackets for the attachment of skin longitudinals to the transverse bulkheads were hydraulically riveted to the longitudinals, and the lugs on bulkheads to receive these brackets, horizontal stiffeners on transverse bulkheads and on middle line bulkhead were also hydraulically riveted to the various parts before they were taken down to the berth.

It will thus be seen that as the erection advanced forward the work was, tank by tank, left in a position ready for riveting up, all the materials required for the structure being in position, with the exception of the longitudinal beams, and as these did not delay progress they were followed up at a convenient interval.

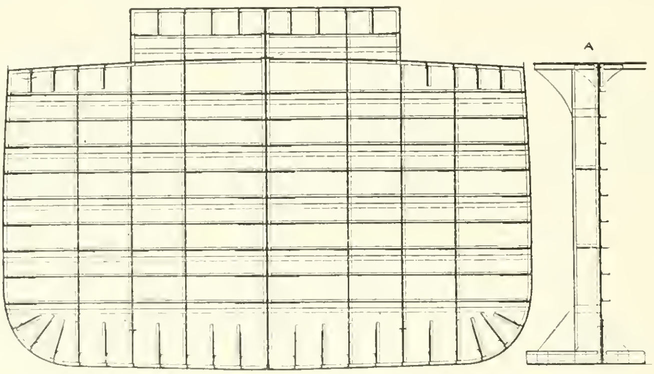
With regard to ribanding, one stout rough riband each side was used at the top of the transverses for securing the same and one on the transverse beams, each side, for fairing purposes and these were all that were found to be necessary. The longitudinals take the place of ribands and only require to be secured to the transverses and to the lugs on the transverse bulkheads, which were carefully templated, and no other fairing was required. No difficulty was found in the laying off of the vessel, and practically the whole of the framing of the structure was made to templates prepared in the drafting loft.

We did not have the assistance of the usual experienced frame erectors, and nearly all the erecting has been done by apprentices, the North-east Coast carpenters, unfortunately, being out on strike owing to a wages dispute.

The officials, workmen and all concerned took a most lively interest in the work, and the predicted obstacles and difficulties of erection of a ship on the new system were found to be non-existent.

Fig. 10 shows an arrangement of transverse materials in a single-decked cargo steamer, having poop, bridge and topgallant forecastle. The spacing of transverses shown is 12 ft., except in way of the double bottom, where an intermediate transverse is shown. This transverse enables the longitudinal stiffening in the bottom to be of bulb angle section, thus making this part very easy of access.

Fig. 8.



OIL TANK SHIP.
Transverse System.

	Tons per sq. in.
Deep Frames (increased as in deep tanks) ..	7·13
Web Frames (increased as is usual in oil steamers)	8·21
Deck Beams (in bridge)	5·04
Deck Beams (clear of bridge, and increased as usual in oil steamers)	4·32
Maximum shearing stresses on rivets attaching deep frames to shell plating	6·7

OIL TANK SHIP.
"Isherwood" System.

			Tons per sq. in.
Transverses—Side			3·76
Transverses—Bottom			3·67
Transverses—Deck			·96
Deck Longitudinals—In bridge			3·8
Deck Longitudinals—Clear of bridge			2·25
	Nos. 1		1·17
Skin Longitudinals.	,, 2	Bulb Angles.	2·34
Skin Longitudinals.	,, 3	Bulb Angles.	3·5
Skin Longitudinals.	,, 4	Bulb Angles.	4·49
Skin Longitudinals.	,, 5	Bulb Angles.	4·38
Skin Longitudinals.	,, 6	Bulb Angles.	4·65
Skin Longitudinals.	,, 7	Bulb Angles.	4·92
Skin Longitudinals.	,, 8	Bulb Angles.	5·46
Skin Longitudinals.	,, 9	Plates and Angles.	5·89
Skin Longitudinals.	,, 10	Plates and Angles.	4·02
Skin Longitudinals.	,, 11	Plates and Angles.	4·34
Skin Longitudinals.	,, 12	Plates and Angles.	3·97
Skin Longitudinals.	,, 13	Plates and Angles.	3·62
Skin Longitudinals.	,, 14	Plates and Angles.	3·31
Skin Longitudinals.	,, 15	Plates and Angles.	—
	,, 16 to 19	Plates and Angles.	3·31
Maximum shearing stresses on rivets attaching strong strong transverses to shell plating ..			4·94
Maximum shearing stresses on rivets attaching longitudinals to shell plating			1 to 5

ALTERATIONS TO THE PATENT LAWS.—The effects of the amendments to, and alterations in the Patent Laws, which come into force within the next two years are apparently declaring themselves already, and when the far-reaching tendency of the alterations is considered, it is not surprising that already those firms who manufacture articles under British patent rights are putting themselves in positions to comply with the new regulations, so that they may be able to cope with the work when the necessity arises. The alterations in the law are made with the object of having all British patented articles made on British soil. Manufacturers, for various reasons, have been getting made on the Continent articles which are covered by British patent rights, and importing these for the home market. In future, this will be carried on to a less extent and it rests to a large degree with the employés of the firms whether or not the change in the law will be to the national advantage, as it is designed to be, and also to the advantage of the worker.

WE have received particulars of test plates which were placed in the waters of the Firth of Clyde with a view to note the effects on metal surfaces coated with anti-fouling compositions. In the neighbourhood of the Kyles of Bute the water is said to be specially prolific in the growth of shell life, while that near Gourock, on the south shore of the Firth, abounds in grass-forming properties. The tests referred to have been made by the Glasgow Patents Co. in order to arrive at a compound which would resist both animal and vegetable life. The desirability of further securing a mixing of an efficient compound which would be homogeneous and thus avoid the settling of the heavier portions, led to further experiments which have resulted in a successful issue. The anti-fouling compositions manufactured by this firm have come into greater prominence of recent years, and a large number of steamers are now being coated with them; the advantage of a composition which is ready for use without requiring to be stirred and kept in motion is manifest, as the manual labour and attention necessary in many cases is considerable to secure an efficient job, and lack of such may give a separation of the colouring from the anti-fouling material in the act of putting the composition on the hull plates.

ELECTRICAL NOTES.

(From our Own Correspondent.)

Arc Lamps.

AMONGST makers in this way is the firm of Johnson and Phillips, who have been identified with the industry from the early days, as we have shown in this column before. Not to be behindhand they have introduced a flame lamp manufactured in two different patterns, one of the vertical carbon type and the other converging. In the former case the impregnation to give the flame is in the positive carbon carried in the lower holder. The consumption is given as low as three ampères per lamp and four or five may be connected in series of 200-220 volts. For docks and similar places a lamp taking 7-10 ampères is recommended. The second type, called Magnet-Juno, relies on a solenoid for striking the arc and the feed of the carbon is entirely by gravity. There are no shunts, coils or dashpots and the mechanism is therefore of the simplest description. The carbons converge and for a diameter of 8 and 9 mm. respectively the lamp consuming from 8 to 10 ampères will run for 10-12 hours without needing retrimming. Any number of these lamps can be run in series, allowing 50-55 volts per lamp, the length over all being about 29 ins. and the weight 20 lbs. Another lamp of the converging carbons class is that known as the Beck, the chief features of which are in the downward control of the carbons. A solenoid is employed in this case also, but there are several smaller details introduced in the way of refinements which are put forward as adding to efficiency, the upward movement of the solenoid plunger being controlled, for instance, by a dashpot. These lamps are all of one type, but of two general sizes. Another firm in this connection is the Electric and Ordnance Accessories Co., of Birmingham, with their Victor lamp. In this case also, the carbons converge, but they are controlled by two ironclad-series coils, one for each carbon holder, which serve to maintain a constant arc length during the burning of the lamp. The arrangement is very simple and provides a direct action on the carbons of the controlling coils, chains and clockwork being unnecessary. The lamp is made to run from fifteen to eighteen hours. A novel form of lamp of this class is the Gilbert by the well-known company of this name, of Chingford, in which the magazine form is adopted. The system is really a multi-carbon one, the arc changing from one pair of carbons to another about every fifteen minutes, the carbons remaining in place, the change being electrical only. The fluctuation is only momentary, meaning a slight diminution of light for perhaps a second. The lamps are constructed as a rule to take six pairs of carbons and the number of hours of lasting is usually 42 to 45, the cost being said to work out at about one-third the price of ordinary flame lamps.

Crane Brakes.

This question has, with the increased use of electricity in this connection, come into some prominence and been taken up by several firms. An ingenious contrivance is that of Messrs. Lawrence Scott & Co., who use the motor field itself and give the magnetic pull for the purpose. To do this a partial gap is made in the circuit of the motor field frame at the root of two pole pieces, so that most of the lines of force pass across the gap and through two hinge pieces to the brake blocks on the drum. With such an action it is said that with no load the brake will be "on" and the armature prevented from attaining a dangerous speed. Lowering is a problem of the controller on this system, sufficient current being allowed to pass through the motor field to take the brake "off" and the load to descend; as the current falls to a minimum the brake will come partly "on." The speed of lowering will depend on the amount of resistance in circuit, but all the while the brake blocks will be bearing against the drum, so that as soon as the controller breaks the circuit the brake will be fully applied and the motor gearing pulled up rapidly. The system is suitable for direct current, the electro magnets giving the brake release and being entirely unsuited for alternate currents.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Doings and Prospects.—The depression in the Clyde shipbuilding industry, which has now prevailed for many months, has become more and more acute as the work of construction and launching has gone on, while there has only been a very partial inflow of fresh orders to counterbalance the output. During March there were launched twenty-six vessels of 22,080 tons, and for the first three months of the year the output consisted of sixty-six vessels of 60,080 tons, as compared with eighty-eight vessels of 121,350 tons, in the first three months of last year. January's contribution consisted of the unprecedentedly small total of 1070 tons, and February contributed thirty-two vessels of 36,080 tons. Besides the greatly diminished volume of tonnage a marked feature of the quarter's output was the increased number of vessels contributing to the total. The average tonnage of the sixty-six vessels is as low as 810 tons. In March alone nineteen of the vessels were under 500 tons, while there was only one of 9000 tons and two of over 5000 tons. All over Scotland the work of the three months was represented by 100 vessels of 76,070 tons the same number of vessels as for the corresponding quarter of last year, but a reduction in measurement of 54,677 tons. The reduction, however, was confined to the Clyde, as on the Forth, the Tay and the Dee, while the number of vessels was less by three, the tonnage was increased by 6590 tons. The tonnage of the new shipping contracted for during the period, as recorded in these notes each month, although larger than the amount booked during the previous two quarters, was quite inadequate to balance the depletion of stocks that has been constantly going on, the total tonnage booked during the three months having been just sufficient to balance the shortage, as compared with the corresponding quarter of last year.

Launching Activity.—As illustrating the way in which launching activity accentuates the depression, existing and prospective, it may be recorded that April 2nd was one of the most productive days in the matter of shipbuilding output on the Clyde that there has been for a considerable period. Seven vessels altogether were sent off the stocks, ranging in tonnage from 11,500 to 94 tons. The vessels comprised the twin-screw steamer of 11,500 tons *Orcomo* for the Pacific Steam Navigation Company, launched by William Beardmore & Co., Dalmuir; the *Salsette*, a twin-screw steamer of 7000 tons for the Peninsular and Oriental Co., by Caird & Co., Greenock; the *Columbia* of 8500 tons carrying capacity for Fratelli Cosulich, of Trieste, by Russell and Co., Port Glasgow; the *Lambere*, a paddle steamer of about 1200 tons for Senor Nicholas Michanevech, Buenos Ayres, by A. & J. Inglis, Pointhouse; the *Itajuba* of about 1200 tons for Brazilian owners by the Ailsa Shipbuilding Co., Troon, and two more drifters, each of 94 tons gross, for East of Scotland owners by Mackie & Thomson, Govan. The aggregate tonnage of the day's output reached about 28,500 tons, and counting a steamer of 1600 tons which was launched at Montrose (the largest vessel ever built there) the total output from Scottish yards reached 30,000 tons, almost an average month's work. Records are no doubt good in their way, but with work proceeding at this pace and with fresh work conspicuous by its absence, abnormal activity in launching is matter for regret than for rejoicing.

New Contracts.—Notwithstanding the foregoing account of disproportionate output and fresh bookings, there are still some crumbs of comfort for Clyde builders and artizans. Messrs. Macmillan & Sons, of the Dumbarton Dockyard, have secured an order for a steamer for Canadian owners. The Greenock and Grangemouth Dockyard Company, Ltd., have contracted with the Anglo-America Oil Company, Ltd., for the construction of an oil tank steamer. The Greenock and Grangemouth Dockyard Company are to build at their Grangemouth yard a steamer of about 2800 tons carrying capacity for Messrs. Ybarra & Co., Seville. The vessel is intended for the Spanish wine trade. Messrs. Lobnitz and Co., Renfrew, have secured an order for two hopper barges of about 700 tons each for the Suez Canal. Messrs. Scott, of Kinghorn, Ltd., have secured an important order from the Spanish Government to build a transport steamer.

Speed Trials of New Steamers.—Satisfaction has been expressed on Clydeside at the results attending the speed trials—carried out on the Mediterranean—of the Italian steamer *Princep di Udine*, built by Messrs. Barclay, Curle and Co., Whiteinch, for the fleet of the Lloyd Sabando Genoa. This vessel ran preliminary trials on the Clyde but her official trials, like those of her sister ship *Thomaso di Savoia* built by the same firm, had to be carried out in Italian waters. The *Princep di Udine* attained a speed of 18·20 knots, the highest speed yet attained by any merchant vessel under the Italian flag. Since the beginning of 1907 at least a dozen fine steamers have been built on the Clyde for Austrian ownership, and other vessels to the same account have been produced by builders at Dundee, one of which, the *Baron Goutich*, for the Austrian Lloyd Co., Trieste, has just passed through her speed trials with satisfactory results. For the passenger and emigrant traffic between Trieste and other Adriatic ports, Mediterranean ports, and New York the Austro-Americano (Fratelli Cosulich, Trieste) have been supplied within the period named with four twin-screw steamers by Messrs. Russell & Co., Port Glasgow. The latest and largest of these—and the largest steamer ever constructed at Port-Glasgow—is the *Martha Washington*, of 8500 tons gross, which was tried for speed on the Firth of Clyde on April 16th, when she attained an average speed of 17 knots. Like the other vessels referred to, she is fitted with powerful propelling machinery by an engineering firm in Greenock, Messrs. Russell & Co. not themselves being engineers. While the deadweight capacity of the *Martha Washington* is large, the accommodation for passengers and emigrants is also notable, the shelter deck type of construction lending itself to this end. Accommodation of a spacious and airy character is provided for sixty first-class and 130 second-class passengers, while the whole of the available space on upper and lower 'tween decks is fitted for the comfortable accommodation of no less than 2000 emigrants. Like the most of the other large Austrian steamers lately produced the *Martha Washington* is fitted with apparatus for the operation of wireless telegraphy.

The Yarrow Removal.—The serious work of transferring the highly special machine tools and other equipment of the works of Messrs. Yarrow & Co., Poplar, to the company's new establishment at Scotstoun on the Clyde is now being entered upon, although, as is well known, the new works, as far as the shipbuilding branch is concerned, have been in operation for some months past. Entirely new overhead cranes of Appleby's and Broadbent's make are installed throughout all the new shops and over the fitting-out basin, and a large number of new tools are installed in the shipbuilding and boiler-making sections; the whole being electrically driven by current obtained from the Clyde Valley Supply Station at Yoker, about half a mile distant. But by far the larger body of machine tools and appliances for the Scotstoun works as a whole has still to be removed from the Poplar works about to be vacated. The Poplar works themselves as presently arranged are not many years old, and this is particularly true of the machinery with which they are equipped. The dove-tailing, therefore, of what is only old comparatively into what is new, and in every way up-to-date, will prove no very difficult undertaking. The working staff at Scotstoun is already largely composed of "old hands" from the Poplar establishment, but the major portion of the Poplar staff will proceed to Clydeside in the order suited to the receipt and installation of the equipment, and incidentally at a time suited to the house occupancy regulations obtaining in Scotland. Mr. A. F. Yarrow himself, it is understood, will take up residence, for the summer months at all events, in the neighbourhood of Killearn, Stirlingshire.

Shipyard Machine Tools.—Some notable machine tools for work in one of the shipyards of Germany, in which naval contracts are almost constantly on hand, are at present being manufactured in Glasgow engineering shops. One interesting item is a set of heavy plate rolls which will rank amongst the largest tools of this description ever produced. This will be capable of dealing with plates 36 ft. 6in. long, 1⅝in. thick

and practically any width. This heavy appliance is being made by Smith Bros. & Co., Kinning Park, Glasgow, who have also recently produced some heavy plate-edge planing machines capable of dealing with nickel-steel plates up to 30 ft. long and 2 in. thick for use in Germany and Japan, as also in the Vickers, Sons & Maxim works at Barrow-in-Furness. Messrs. J. Bennie & Sons, Cardonald, Glasgow, have just installed a set of large plate-bending rolls in the works of J. and C. Grayson, Ltd., Liverpool. This machine tool is capable of rolling, cold, plates 35 ft. long and 6 ft. wide, and 1¼ in. thick. Like the tools before mentioned, this appliance is electrically driven.

Gunmaking at Parkhead.—In the new gun factory at the Parkhead Works of Messrs. William Beardmore & Co., Ltd., preparations are now entered upon for the construction of the first twelve-inch naval gun that has ever been made in Scotland. The weapon is to be built in execution of a preliminary order received from the British Admiralty. The modern naval gun is an elaborate and complex structure. For the purpose of resisting strain it is built up with a series of tubes shrunk, each upon the other, and between the inner tubes something like 110 miles of steel wire are wound round for the purpose of taking up the concussion of the firing. The twelve-inch gun fires a projectile weighing 850 lbs., which is discharged with an initial energy capable of perforating four feet of solid iron. The value of such a weapon is set down at about £12,500. It is anticipated, of course, that when the Admiralty have satisfied themselves of the efficiency of Messrs. Beardmore's factory, many more orders will be sent to Glasgow for such effective weapons.

Seamless Tubes.—The Inshaw Seamless Iron and Steel Tubes Company, whose new works at Wishaw are now partially in operation, have arranged with the Coltness Iron Company for that Company, through the payment of £20,000, to acquire the right of working, at the Coltness Works, the Inshaw Company's patent for weldless tubes. An arrangement has also been come to between the companies with regard to the prices at which their respective outputs will be disposed of. It is understood that extensive plant for this new department is to be laid down at the Coltness Company's works, Newmains.

Floating Dock for Aberdeen.—A new floating dock, built to the order of the Aberdeen Port Commissioners, and intended mainly for the accommodation of steam trawlers and other fishing craft, was launched on the 4th inst. by Vickers, Sons & Maxim, Barrow-in-Furness. This will be the second dock at Aberdeen, and has been rendered necessary by the increase in the shipping of the port. It will be stationed in the Albert Dock basin, shored off the quay by strong booms. It is built wholly of iron, has a lifting capacity of 600 tons, and is 60 ft. long by 42 ft. broad. The pumping machinery consists of horizontal centrifugal pumps placed in the bottom of the pontoon under the side wall, and driven by electric motors, controlled from the top. The dock is shortly to be towed round from Barrow *via* the North of Scotland by two powerful tugs.

THE TYNE.

(*From our Own Correspondent.*)

The Industrial Disputes.—In connection with the shipbuilding disputes, a new development of an important character has taken place within the past week. The employers, it is understood, have decided upon bringing about something approaching to uniformity of wages rates throughout the country, so that no one district shall be handicapped by excessive labour costs, as compared with another. It is also anticipated that wages changes in future shall be national in scope, and it is quite probable that under some system of conciliation, the annual adjustment of rates shall be provided for. If a scheme for periodical wages settlements has not already entered into the employers' plans for the future, there is little reason to doubt that some such movement will ere long be initiated. Otherwise, the trade of the country is bound to go from bad to worse, as in every recent strike the men have disregarded the advice of their leaders, and acted as if they were in no way under control by their respective governing bodies. So long as insubordination is thus flagrantly practised by the rank and file of trade unions, there will be no possibility of peaceable adjustments of disputes, and the country will be always in a ferment, to the serious injury of trade. The national lock-out of shipyard workers (which was hinted at as a coming possibility in last month's notes), is now regarded as certain to take place at the end of the present month, and this event will have an important bearing upon the question of wages changes in the future. The shipyard men at all the centres are now voting upon the alternative proposals (put before them by their leaders), of accepting the reduction of 1s. 6d. per week originally asked for by the masters, or submitting the question to arbitration. It is felt that the voting will go in favour of the latter, which is a question that has not been considered by the employers, and is not likely to meet with acceptance by them.

It will be noted that Mr. Barnes, the General Secretary of the Engineers' Society, has resigned his position, owing to the discreditable action of the North-East Coast members, of whom he seems thoroughly ashamed. There appears to have been some divergence of views between him and his Executive as regards the policy of taking a national vote upon the questions involved in the Northern strike, and this difference has resulted in Mr. Barnes' retirement. The engineers of the North-East Coast, being now without a leader, do not seem to know exactly what they want, and the Executive Council seem unable or unwilling to help them out of their difficulty. Certainly, there is some question of the fixing of a minimum wage being put forward in the local papers, but the employers are not likely to entertain such a proposal should it ever come before them. Neither maximum nor minimum is just in principle, as labour is a commodity the value of which is bound to fluctuate according to the demand.

The Elswick Yard.—This establishment has a satisfactory amount of work on the stocks, one or two of the vessels in hand being still in early stages of construction. There are vessels in the water being fitted out, and a large number of platers, riveters and other workmen are engaged in this work. It is rumoured that new orders of an important kind have been secured within the past couple of weeks; but nothing definite has transpired, and the matter is therefore, as yet, in the region of surmise. At the Low Walker Yard of Messrs. Armstrong, Whitworth & Co., the berths are still fully occupied and large quantities of material are being delivered. The death of Mr. J. Wigham Richardson, of the Neptune Yard, Low Walker, has just been announced; but this regrettable event is not likely to materially affect the course of business, as the family is still well represented in the firm so widely known as the builders of the Cunard liner *Mauretania*. It may here be stated that this great firm has in their Walker and Wallsend yards sixteen building berths, one of which is 900 feet long, and when they are in full work can employ no less than 8,000 workmen.

Messrs. Wood, Skinner & Co. have a considerable amount of work in hand, the success of the firm in this respect being, as we understand, largely attributable to the careful attention given by the management to customers' special requirements.

Messrs. Dobson & Co. have a couple of vessels on the stocks, and two in the water receiving their final equipments. It is also reported that the firm have recently received an order.

Messrs. Hawthorn, Leslie & Co.—This well-known firm have two berths occupied with vessels of large size, and have also some torpedo destroyers on the stocks. In the water several vessels are being fitted out, or otherwise receiving attention, and the graving dock department is kept in steady operation. Very little change has taken place in the state of business at Messrs. Stephenson's since last month, and at the Palmer Company's works, appearances are not indicative of prosperity. The town of Jarrow is to a large extent dependent on this firm's prosperity, and it is to be hoped that the various departments will soon feel the touch of the "rising tide." It is but meet, indeed that the firm should be rewarded for their enterprise in equipping with electrical hoisting gear of the most effective kind two of their principal berths, especially as these aids to economic working must enable them to offer exceptionally advantageous terms to clients. Their success in the building of war vessels is universally admitted, and the reputation founded upon this class of work must necessarily be of great assistance to them in competing for mercantile orders.

The Tyne Shipbuilding Co. have two vessels on the stocks and one in the water being fitted out, and at Messrs. Readhead's yard arrangements are being made for the placing of

another keel. The Smiths Dock Co. have a number of orders for fishing vessels, and that department of their works is very busy. Their pontoons and graving docks are almost fully occupied, and in the engineering shops belonging to the Company, business is active.

It is announced that a new graving dock of large capacity and which is to be fully equipped with up-to-date appliances, is to be made at West Holborn, South Shields. The demolition of house property in the vicinity of the site is being proceeded with, and it is expected that every possible effort will be made to push on the work to an early completion. It is expected that the dock will be available for the accommodation of vessels within a year from the time of commencing excavating operations.

The number of vessels laid up in the Tyne for want of employment, has been largely increased since last month.

THE WEAR.

(From our Own Correspondent.)

The Outlook in Shipbuilding.—Though the outlook in the wider sense is not particularly cheerful, a brightening of aspect is becoming noticeable at one or two of the local yards, and in these times even so small a mercy as this is something to be thankful for. Messrs. Blumer & Co. have placed the keel for another vessel, and have now their three berths occupied. One or two of these vessels were, it is true, booked several months ago, and, it is understood, are not wanted till next year: yet, their construction will have to be proceeded with and however slowly the work may be carried out, it will for a time provide employment for some of the many hands now seeking it.

Messrs. Bartram & Sons, of the South Dock, whose yard has been idle for some months past, have just placed the keel for a large vessel, and heavy deliveries of steel angles and other material are being made at the yard daily. The adjoining establishment of the Sunderland Shipbuilding Co. has been satisfactorily employed throughout the winter months and the management, it is understood, have still some work to go on with. The Wear Commissioner's Graving Docks have been kept fairly well employed for some weeks past, and it is stated that there is sufficient work in prospect to keep them occupied well into the summer.

The yards above bridge, with the exception of Messrs. Doxfords, are showing evidence of extreme slackness, but at the establishment named briskness is still the feature, and it is rumoured that more orders have been booked recently. Repair work is still keeping a large number of hands well employed at Messrs. Austin's, and it is expected that further important contracts for survey of old vessels will in this instance soon be forthcoming. A limited number of men are engaged at Messrs. Laing's in carrying on to completion the work that was on the stocks when the firm's monetary troubles first became known, but nothing has been definitely settled as to the carrying on of the business after the contracts referred to are worked up. There are a few steamers laid up in the Wear, and this, of course, tends to accentuate the appearance of general slackness.

Engineering.—The imbroglio created by the action of the amalgamated engineers in rejecting the employers' proposals for a settlement, is still the cause of general complaint, as it is felt that no real improvement in business can take place until pacific relations between capital and labour in this industry are again established. A solution of this difficulty has to be found, and the employers may soon have to resort to the drastic measure of a national lock-out, if no other solution is within sight. This wrangle in the engineering trade has lasted altogether too long, and the employers must contrive to do without the members of the A.E.S. if they are found to be absolutely inaccessible to reason.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

Manchester Ship Canal's Position among the Ports.—From returns furnished by the Board of Trade, we find that Manchester stands fourteenth in the list of British ports according to tonnage. In the previous year she held the fifteenth place. In the coasting trade, Manchester has risen from the twenty-second place in 1906 to the eighteenth in 1907, having passed Plymouth, Aberdeen, Blyth and Greenock. During 1907 the foreign Manchester trade increased by 63,027 tons, but the increase in the foreign trade by other ports was far in advance—the Tyne ports showed an increase of 890,000 tons, Hull by 796,000 tons, Cardiff by 425,000 tons, Middlesbrough by 176,000 tons, Newport by 154,000 tons and Glasgow by 75,000 tons. The increase in the Manchester coasting trade in 1907 amounted to 119,000 tons, but at Cardiff it went up by 236,000 tons, Liverpool by 169,000 tons and Glasgow by 160,000 tons.

Ship Canal Rate.—The representatives of the Manchester Corporation on the directorate of the Ship Canal Co. announce that not only will the Ship Canal rate be reduced this year a penny in the pound, but that next year the probability is that no rate will be required. It is anticipated that the Ship Canal Co. may be in a position to pay, in addition to the full sum of £160,000 for interest on Corporation debentures, a sum on account of the dividend on the Corporation preference stock sufficient to cover the amount of sinking fund—£26,273—required to be set aside annually by the Ship Canal (Finance) Act.

Mersey and Irwell Joint Committee.—Sir John T. Hibbert has resigned the chairmanship of the Mersey and Irwell Joint Committee, and has been succeeded by Dr. Basil Hewitt, the deputy chairman. It is claimed that much has been done towards purifying these two important rivers during the period of the committee's existence. Out of ninety-four local authorities within the district, eighty urban and ten rural districts have now purifying works in operation, leaving two urban districts and one rural district with no scheme, and one urban district with a scheme under consideration. Of the 393 manufacturers on the two rivers 296 have efficient works, while eighty-three have works constructed, but not efficient, leaving fourteen without treatment, and twenty-six works whose effluent goes into the sewers or have been closed.

Cotton Imports.—The total imports of American cotton to Manchester this season amounts to about 323,490 bales, and of Egyptian cotton 172,660 bales. These are below last season's figures. As cotton begins to fall off timber imports are coming in more freely.

Textile Trades.—At last our textile trade is suffering a relapse. The imports last month were only £52,115,259, a decrease of £5,625,962 compared with March, 1907, and the exports totalled £32,893,424, a decrease of £1,829,610 compared with the exports during the corresponding month of 1907. Raw cotton imports in March showed a decrease of £3,403,718, the total being £4,579,218. Exports of cotton yarns and textile fabrics showed a decrease of £695,979, compared with March last year. Exports of coal, coke and manufactured fuel, however, last month totalled £3,331,189, being an increase of £341,653 compared with the total exports in the corresponding month of 1907.

Lancashire Coal Fields.—For inspection purposes, the Lancashire coalfields are divided into two districts—Manchester and Liverpool. In 1900, 98,096 persons were employed in mines under the Coal Mines Act; in 1907 the number had risen to 110,686, an increase of nearly 13 per cent. The mineral raised in 1900 was 28,258,997 tons; last year the total output amounted to 30,432,346 tons. In 1906, 55,599,771 tons of coal were exported from this country; last year the total had risen by over 8,000,000 tons, the total being 63,600,947 tons. Sir Lees Knowles, a large Manchester colliery owner, declares the Miners' Eight Hours' Bill to be absolutely unworkable. It was certain to diminish the output or increase the cost, or both; and an increase in the cost would affect all sections of the community.

Liverpool Engineering Society.—At a recent meeting of the Liverpool Engineering Society Mr. W. D. Kirkpatrick stated that electric lighting has been known afloat for thirty years, but it was only within recent years that 100 volts had been exceeded on board vessels. Electric power was the most economical, assuming auxiliary machinery to be on board. An electric installation was more costly than steam, but would show a very large saving in coal.

United Alkali Co.—At the annual meeting of the United Alkali Co., Ltd., at Liverpool, the net profit on the year's working amounted to £345,162. Chemicals, however, it was stated, did not respond to the rise in the cost of raw material required for their production. They had nothing to fear

from foreign competitors in England, and in the manufacture of colours in England by German manufacturers, even saw an opening for some of their own goods.

Collision.—Collisions and accidents seldom occur on the Ship Canal, but recently the *Delegarth* and the *Carbineer* collided. The latter vessel was unable to proceed on her journey and her cargo had to be transferred to another vessel.

Shipping Rings.—It has been stated before the Shipping Rings Commission in London that the ocean transport from this country to Toronto and Winnipeg, *via* the ports of Montreal in summer and St. John's, Halifax, and Portland in the winter, is in the hands, from Liverpool, of a combination known as "The Canadian North Atlantic Westbound Conference," which comprises the Allan Line, from Liverpool and Glasgow; the Canadian Pacific Railway from Liverpool and Avonmouth; the Dominion Line from Liverpool and Avonmouth; the Manchester Liners and lines from Glasgow and Newcastle. There is no competition and rates, consequently, have gone up.

Lancashire Iron Trade.—The state of the Lancashire iron market continues depressed in raw and manufactured iron. Many blast furnaces have been closed. The competition in metals from the Continent presses heavily on English manufacturers.

Lancashire Coal Trade.—The coal trade is strong. The depression in the iron trade has had only a very slight deterrent effect upon it. The weather, the shipping trade, and the cotton boom has served to keep colliers fully employed. The average prices of all kinds of coal have been undisturbed for months past.

THAMES.

(*From our Own Correspondent.*)

Port of London New Authority.—The terms of the Bill to promote the above scheme are no longer in doubt. The cards have been all displayed by the late President of the Board of Trade in the House of Commons and we know exactly how the matter stands. First the London and India Docks Co. came in on agreement, followed by the Millwall Dock and lastly by the Surrey Commercial. Everything in this matter has therefore been in keeping before the President's retirement from office and it only remains to fill in the details of the scheme. The Docks have a total acreage of 631, the London and India Co. owning 430 of these. When, therefore, the agreement of the largest company was secured, a great step was made, because the smaller companies were less likely to stand out. What, then, are the terms of purchase? There are to be two classes of Port Stock, *viz.*, A stock with interest at three per cent., ranking first in priority, and B stock at four per cent., ranking after the A stock, and pending transfer the Companies will pay only three per cent. dividend on their holdings, the terms being for the London and India Co. that their best classes of stock will receive par value upon A stock in the new authority, while the preferred, following on the leading security will get paid in B stock on same terms, and the ordinary shares will meet in the one case with par value of B stock and in the other the deferred with only 75 per cent. In the case of the Millwall Co., the division is necessarily different, but it will be sufficient to say the leading stock, the 5 per cent., gets paid in 133½ of A stock and 25 of B stock, while the ordinary receives only 20 of B stock. In the case of the Surrey Co. the leading stock, the 4½ per cent. debenture, receives £150 of A stock, while the £100 share ordinary is transferred at £95 of B stock, the gradations being as in the Millwall Co.'s case, between these extreme figures. The total allocations of the three Companies are as follows:—

	3 p.c. A	4 p.c. B
London and India	£7,878,876	£9,893,836
Millwall Dock	651,276	928,484
Surrey Commercial	522,000	2,388,486
Total	£9,052,152	£13,210,806

The interest on these amounts will reach about £800,000 per annum, so there should be no difficulty in earning a substantially larger sum. The above gives, therefore, a financial review of the question and it will be seen that the matter has been settled on a thoroughly sound basis, and all the better that it has been accomplished without recourse to expensive litigation for either side. At the outset, therefore, the new authority enters into possession of a tangible asset in these docks, the water area of which comprises 644 acres. That economy should be possible in the way of administration does not follow from our past experience of these large authorities, but there should be greater efficiency. It is expected the new powers will commence next January and thereby, not only the Dock Companies, but the Thames Conservancy and the Watermen's Co. will be superseded. The system followed is that of the Mersey Docks and Harbour Board, and the composition will be twenty-five members, of whom the traders and shipowners will elect fourteen, the Admiralty one, Board of Trade two, London County Council three members and two non-members, City Corporation one and Trinity House one. The fourteen elected members will be by payers of dues, owners of river craft and wharfingers. In the first case the Board of Trade will appoint these fourteen. The debenture holders in the Thames Conservancy will receive Port Stock and the income of the new body will be derived from the present dock dues, the levies of the Thames Conservancy and from the following new sources:—dues on goods, tonnage dues of 1s. 6d. per ton, registration fees on barges, and continuance of increased Conservancy dues for river improvements, which would otherwise cease this year. The duties and powers of the new authority are given as (1) the general requirements of the port as a whole; (2) the construction of new docks; (3) the purchase of land; (4) the co-operation with others for additional port facilities. The above then are the main features, but there are others, such as compensation for directors of the Companies in Port Stock, the salaries of chairmen of the New Board and the control by the Board of Trade, which we need not enter into here. The officers of all bodies will be transferred to the new Authority on the same terms as at present. Generally, we see that in the future the port will be free from all political complications and will be, as it ought to be, pre-eminently a trading concern working for the good of the port as a whole. The docks, as docks, have had their day. The system inaugurated by them is not adaptable to present-day Free Trade conditions and the charges have had to be notoriously high, four times what it is at Antwerp and Hamburg, for instance. It is conceivable, therefore, that all this will be changed and the port enter upon a new and prosperous era under the new *régime*.

Companies' Reports.—The Thames Shipbuilding Co. make a good report for 1907, there being a profit of £20,861. Twin-screw steamers for Turkey have been built and torpedo boats for Roumania, also lifeboats for the National Institution. The completion of Admiralty contracts for the Dockyards has been followed by a large order for the Tanjong Pagar Dock Board of Singapore. With the balance in hand a dividend of 5 per cent is paid on the preference shares and £19,538 carried forward. The African S.S. Co. at their annual meeting under Lord Pirrie declared a dividend of 5 per cent.

Greenwich Pier Dispute.—There seems no likelihood of this matter reaching settlement, the Admiralty not being apparently disposed to give way. Negotiations are understood to be still pending, but there is little likelihood in any case of the Council getting back its £21,000, which was paid for the freehold, as any profits made will have to go in reducing tolls and not in diminishing rates.

Thames Steamboat Service.—As the summer season is near at hand, it was expected the old Company would come on the scene again, but apparently this is not to be the case. The Council is on the horns of a dilemma, because there is an expenditure of £13,000 in the upkeep of the piers. Whether, therefore, the Council will run a service under these conditions is not yet decided, but we cannot remain much longer in doubt over the matter.

Motor-Boat Show.—At the recent Olympia Exhibition, there was a very good display. Such firms as Brooke & Co., and Thornycrofts were in evidence and the Wolseley Co. with engines. The Maudsley Motor Co., of Coventry and King & Co., of Limehouse, are other firms noticed, also the Ailsa Crag and Motor Co., of Chiswick. This was probably the best display of marine motors ever got together.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Prospects. It cannot be said that the prospects are of a very rosy nature, inasmuch as nothing in the way of orders has been booked, and the immediate future does not appear to hold any work for the big shipbuilding yard at Barrow. In a month or two the number of vessels in hand will have dwindled down to a very few. Rumours are about, but there is no corroboration from official quarters of them. On the stocks there are the *Vanguard* of the *Dreadnought* class, the Brazilian battleship, a floating dock for the Government for submarines and a small (comparatively) steamer for Vickers. In the docks fitting out are the *Ben-my-Chree*, the *Rathmore* and the Mexican transport *General Guererro*. When these three latter vessels have gone, which they will do in a couple of months, there will be nothing at the fitting-out wharfs at all until the *Vanguard* is launched. Of course, Barrow is no worse off than other yards at the present and better than some.

The Spanish Rumour.—Some time ago Dame Rumour had much to say about the Brazilian battleships. Now it is the turn of Spain to come in for treatment. A Spanish provincial paper, *El Correo Gallego*, published what was claimed to be authentic information of the intention of Spain to build new vessels for their navy. The total expenditure projected was 186,510,000 pesetas or about £7,000,000 in English money, and it was stated that the firm of Vickers, Sons & Maxim would secure the lion's share of the contracts for the building of the new squadron. This announcement, of course, caused immense interest in the Barrow district. It was immediately denied at Sheffield, and by another correspondent was said to be premature, but that there was "some substance of truth in it." Later on, it was said to be far too sanguine. As far as publicity goes that is how the matter stands at present. It is impossible to obtain any confirmation from any official source. That there is something in the rumour there can be no doubt. It is known that Spain has voted something like £7,000,000 for the beginning of a new navy, but how much of that will find its way into the books of British shipbuilders it is impossible to say at the present. There is the same trouble in Spain as in Russia. Each country has a strong faction which insists upon their war vessels being built in the country. Neither country can hope to equal the work of a British shipbuilder, and in any case would have to look to Britain for armour, engines, guns, etc., etc. As to costs of production, they are hopelessly behind. Still those factious may be strong enough to force the hands of the Government. That remains to be seen. In the case of Spain, she has neither appliances nor men capable of the work of building a first-class vessel. Another thing, work would be so slow. Some time ago that country made inquiries in the United Kingdom of several shipbuilders, and a report was circulated widely in the press that "Beardmore's had secured orders from Spain for the building of a navy, the cost of which was to be £7,000,000." Now it is Vickers. Some few weeks ago, there was another rumour, which did not get into the press, to the effect that Spain had found several of the builders too dear and that they were in treaty with Cammell's. That was neither confirmed nor denied, and can be put down as merely a rumour. But there is no smoke without a flame, and it would not be surprising to hear that Vickers' had booked some orders from Spain, and that Beardmore's of the Clyde would share them. There is something in it, for there can be no doubt that Vickers' have had the matter before them, but whether the ships will be built here or whether the material only will be supplied, together with, say, several sets of engines for the fast vessels, cannot be said at the moment. The sooner affairs take a more definite shape, the better this district will be pleased.

The "Vanguard."—The keel of the *Vanguard*, which is an advanced type of the *Dreadnought* design and of the *St. Vincent* class, has been laid, and work has been going on since at a great rate. The keel would have been laid before, but the express turbine steamer *Ben-my-Chree* was on the blocks and this kept the battleship back, but only to a slight extent. Long before the keel was laid, work was going on, and some idea can be gained of this when it is known that within two weeks of the laying, there was no less than a weight of over a thousand tons on the blocks. Everything was ready for dropping into place by a huge cantilever crane. There will be no mistake about the turning out of this vessel and not a minute is to be wasted. The organization in connection with her construction is perfect. Since the placing of the order there have been some important alterations in the designs, and these will increase her tonnage several hundreds of tons. If matters go on all right and there are no strikes or lock-outs to mar the rest of this year's working, the *Vanguard* will be launched about November this year. There has been much said as to the heavy guns she will carry, and it is reported that instead of eight 12 in., she will have eight 13·5 in. It would not be surprising at all. It is a fact that such big guns are under consideration and even construction, but there is a lot of secrecy about it all and likely to be. There is no information of any of these guns being tested yet by either private firms or the Admiralty, so it seems rather early to talk of putting them on vessels which in two years from now are to be complete and in the hands of the Navy. These big guns will come about sooner or later in the British Navy. The foreign Dreadnoughts carry twelve heavy guns, which are mounted in two side barbettes and two forward and two aft. The forward and aft barbettes are mounted one above the other. This is a practice that does not find favour with the British, for many reasons. It may safely be said that the British practice is the best, and ere long there will be another step taken by them that will place the countries that copy them at as big a disadvantage as the building of our *Dreadnought* did. The fitting-out wharf for the *Vanguard* with its great 150-ton cantilever crane is nearing completion. It will prove of great service to Vickers.

The "St. Paulo."—The work on the Brazilian battleship proceeds slowly. Not very many men are engaged upon her, and her launching will be after the *Vanguard*. A certain amount of interest centres itself upon this vessel and her sister ship building on the Tyne at Elswick. It would be interesting to take a look into futurity and see the ultimate destination of these two leviathans. They are, according to some people in the know, unsuitable for the British, for neither in storage nor efficiency do they come up to the hard and fast rule of our country's navy. There is no country in the world which is so particular. They are more so now than ever they were. One never knows what may happen between now and their completion, in respect to the attitude of one Government to another, but, as the American-Japanese talk is subsiding, the owners may have to keep them and that, according to what we are informed, is just what they do not wish to do.

The "Ben-my-Chree."—Since this fine vessel has been launched, a record has been created at Vickers'. Never has a vessel grown so much inside and out as she has done. From the very moment she was moored alongside the wharf she has been a veritable beehive. She is wanted in a hurry, and it will be something very serious that will stop the builders from having her ready for Whitsuntide. Her extensive machinery is nearly completed, and some of it is already in. None of the boilers as yet are in. When completed she will present a very fine and bold appearance, and should prove a valuable boat to the owners, the Isle of Man Steam Packet Co. She will be the largest, fastest, and finest looking cross-Channel steamer afloat.

The "Rathmore."—This smart serviceable 20-knot passenger steamer, built to the order of the London and North-Western Railway Company for the Irish service, is nearing completion, and will soon be ready for her trials. She appears to have larger funnels than the *Anglia* or *Scotia*. They are of the "Fairfield" type and greatly improve the appearance of the vessel. There is no cheese-paring in the building of this class of vessel, the owners always going in for the best. This practice has had the best results and it is a pity others do not copy the principle. She should prove a useful adjunct to the company, especially as they appear to be extending their services and making a bold bid for the Kingston traffic.

"General Guererro."—The Mexican transport-cruiser is practically ready and will shortly sail on her trials. Though small she is very compact, and it is remarkable the accommodation for man and animal there is upon her. She will carry two four-inch and four quick-firing guns. There does not seem to be any great hurry necessary for her getting out and consequently men have been put on the more urgently needed ships.

Submarines.—The "C 16" or, to give her the new number, the "46," is almost ready for delivery, and the tender H.M.S

Hazard is expected the beginning of the month to take her round to Portsmouth. Many more are building, including the two Japanese, but none have been launched. The D class are said to be larger, more powerful, and more useful and some will be put in the water shortly. Several are known to be under construction in the yard and in the secret shed.

A Vickers' Patent.—A patent relating to reversing gear for internal combustion engines has been taken out by Vickers' and Mr. James McKechnie, manager. It is a reversing gear for internal combustion engines and particularly to reversing gear for heavy oil engines. The chief object is to provide means whereby the operation of such engines may be so regulated that they can be run in either direction with equal facility. For carrying this into effect the reversing gear is employed of the class wherein each of the engine controlling valves is provided with a forward and reverse cam and with two independently pivoted members, either of which can be interposed between its respective cam and the valve spindle or other controlling device for controlling the engine to run in a forward or reverse direction. This patent probably has to do with engines for submarines.

West Cumberland.—There has been nothing of note in this district as regards shipbuilding. The work is only small and the output very limited.

Engineering.—There is a quietness at the present time in the gun-mounting departments. In the other branches there is plenty of work to go on with for some time. The turbines for the *Vanguard* are in hand, as also the reciprocating engines for the two Brazilian battleships. No new orders are to be noted.

Floating Docks.—The floating dock for the Aberdeen docks has been launched and taken in tow by one of the Jolliffe tugs of Liverpool. It is only intended for the steam trawlers visiting the port, but possesses every facility for the rapid dealing with this class of vessel. There is another floating dock on the stocks which is building for the British Admiralty. This is to be used by the submarine craft. It is more than likely that the Government will want more of these pontoons in order that there may be accommodation at each naval base.

Hæmatites.—The Barrow Steelworks are closed and may be for six months. This is owing to the poor state of trade. The amonnt of trade doing in iron is very small, and prices remain about the same.

Shipping.—Shipping is very poor indeed, and the exports of iron and steel show a decrease weekly as compared with the previous year. This year's aggregate as compared with the same period of 1907 shows no less than 130,000 tons decrease.

SOUTHAMPTON.

(*From our Own Correspondent.*)

Chamber of Commerce Banquet.—At this banquet which took place at the South-Western Hotel, reference was made to Messrs. Harland & Wolff's new engineering works, now nearing completion and which employ about one thousand men, also to the coming of the White Star Line which had been a red-letter day for the port. The town has now three influential bodies working for its interest and advancement, *i.e.*, the Corporation, the Harbour Board and the London and South-Western Railway, the latter having invested four and a half millions sterling in the acquisition and development of the docks, and this would shortly be largely increased by the expenditure on the new wet dock now under construction.

Torpedo Base.—The Admiralty have now definitely decided on the position of the moorings in Southampton Water for the mosquito fleet of torpedo boat destroyers, etc., although the date for the transfer has not been definitely fixed. Some time ago a conference took place between Sir Day Bosanquet, then Commander-in-Chief at Portsmouth and the Harbour Master, acting under instructions from the Southampton Harbour Board, when moorings off Netley were suggested for the larger vessels and the Hamble River was suggested for the destroyers and torpedo boats, and this arrangement has now been confirmed by the Admiralty.

Messrs. Day, Summers & Co., of Northam Ironworks, have a large amount of work in hand. The S.Y. *Medusa* has been off the slip and is now lying in the stream completing her fitting out. The S.Y. *Sapphire* has been in dry dock for painting, and is now completing fitting out in the docks. The Isle of Wight Co.'s paddle steamers *Queen* and *Lorna Doone* were both on the slips last month. Rapid progress has been made with the two Tug boats for South America—and by the time these notes are in print both will be completely plated. The machinery and boilers are also well advanced. Other yachts dealt with during April were the *Vanduara*, *Assagai*, *Madrigal* and *Hiawatha*, which have all been on the slip. The *Sabrina* is expected at the yard about the middle of this month, and she will also go on the slip.

Messrs. J. I. Thornycroft & Co., of Woolston Works, have just completed the Customs' cruiser *Suriya Monthon* to the order of the Siamese Government. The vessel is 137 ft. long, with a beam of 18 ft., and depth 9 ft. 9 in., and has been constructed under the supervision of Sir Wm. H. White, K.C.B. The contract speed was 14½ knots, and on trial the vessel maintained a speed of 14¾ knots. She left Southampton on the 15th April last for Siam, proceeding *via* the Suez Canal. A full description of the vessel will be found on page 399.

The R.M.S.P. "Oroya" completed her voyage to the West Indies and New York on Monday 6th April, and will sail from Tilbury on the 15th of this month, resuming her place in the Company's Australian service.

HULL.

(*From our Own Correspondent.*)

Docks.—The docks are at present rather quiet, both in regard to inward and outward-bound ships, but there are signs that work will improve very shortly, particularly in regard to coal shipment, owing to the near approach of the opening of the Baltic navigation, and large shipments are expected to be made, particularly to the Northern Russian ports such as Cronstadt, St. Petersburg, Riga and also to South Finland.

Cooper & Co. are fairly well occupied with repair work. And in the metal foundry, where they make a special design of propeller which gives very good results, they are working day and night in this particular branch.

Earle's Shipbuilding Co., Ltd.—This firm has little fresh to report more than the new work they had in hand last month; they are getting a few more inquiries for new steamers, but the state the labour market is in at present makes them cautious in quoting prices.

Amos & Smith with new work are only moderately employed, but with repair work they are well employed.

Central Dry Dock and Engineering Works have been full of repair work for a long time, and they have just finished a large overhaul on board the s.s. *Duke of Clarence*, prior to her commencing her summer runs between Hull and Zebrugge. On the overhaul being finished she went her trial trip out to sea, which proved to all on board most satisfactory.

BELFAST.

(*From our Own Correspondent.*)

State of Trade.—There is not anything approaching the same slackness on the Lagan that is being at present experienced in most other shipbuilding centres; still, trade cannot by any means be termed very good. According to Lloyd's quarterly returns the amount of work in hand at the end of March was 172,530 tons, as compared with 194,507 tons at the end of December, while at the end of March last year the figures were 220,135 tons.

Messrs. Harland & Wolff.—There has recently been a good deal in the press about big ships and rumours of big ships, and now we have the report that the White Star Company contemplates the placing of an order for at least one leviathan which is intended to eclipse anything afloat in point of size. 1000 ft. in length being spoken of. There is, of course, no dry dock accommodation available for a vessel of this size, but provision could be made in this respect during the long period which would necessarily elapse between the placing of the order for such a vessel, and her completion. Should

this big liner be built—and the White Star Company confirms the report that a vessel of huge dimensions is to be ordered—needless to say the order will be placed with the Queen's Island firm. On the 16th of April Messrs. Harland & Wolff launched the new Leyland liner *Mercian* from the south end of their yard. The new addition to this well-known fleet is a vessel of about 6500 tons, and is a sister ship of the *Median* and *Memphian* recently constructed here for the same owners. The Aberdeen liner *Pericles*, built by Messrs. Harland & Wolff, is practically completed for sea, but it is understood that she will not be required to take up her sailings until August.

Messrs. Workman, Clark & Co.—At the end of March this firm had a successful trial of the fruit-carrying steamer *Marowijne*, which they constructed for the Royal West Indian Mail Company, of Amsterdam. She is 352 ft. long, with a gross tonnage of 3500 tons, and is a sister ship of the *Coppename*, built for the same owners a short time since. The propelling machinery consists of a set of triple-expansion engines, steam being supplied by three boilers fitted with Howden's forced draught system. During the trials an average speed of $14\frac{1}{2}$ knots was obtained, that being in excess of the contract speed. On the 31st March, Messrs. Workman, Clark & Co. launched from their north yard the twin-screw liner *Verona*, which is the second steamer built by them for the Steam Navigation Company, Italia, of Genoa. She is 500 ft. in length, with a gross tonnage of about 9500, and will be propelled by two sets of triple-expansion engines, with all the most approved auxiliaries. Messrs. Workman, Clark & Co. have, it is understood, accepted all responsibility in connection with the sinking of the Harbour Commissioners' twin-screw tug *Musgrave*, to which reference was made in last month's notes, and are carrying out the repairs themselves at their own expense.

Messrs. Maccoll & Co.—On the 9th April the twin-screw steamer *Cariboo*, built by Messrs. Ailsa Shipbuilding Co., Ayr, for the Union Steamship Company, British Columbia, had a most successful trial trip on the Clyde. The *Cariboo* is 156 ft. long by 32 ft. beam, by 15 ft. deep, and the machinery which was constructed and fitted on board by Messrs. MacColl and Co., Belfast, consists of two sets of triple-expansion balanced engines. The speed trials, run on the Skelmorlie mile, resulted in the attainment of 12 knots, this being in excess of that guaranteed, and earning a substantial premium for the shipbuilders and engineers. After a highly satisfactory series of progressive trials the vessel returned to Ayr for completion of her papers, sailing thence to Barry to coal for the voyage to Vancouver.

JUNIOR ENGINEERS.

XIX.*

Machines.

THE types of machines that form a basis from which the refinements of modern tools have been evolved may be classified as planing, slotting, boring, milling and turning, which, with shaping and drilling machines, turning mills and grinders, comprise most of those in general use.

The planer provides a mechanism in which the work is given a to-and-fro motion upon a horizontal table which, moving upon two slide bearings, is operated by means of a shaft and pinion gearing into a rack fitted to the under side of the table. The pinion shaft is rotated by belt and pulley, and the reversing motion is obtained through gearing on a separate shaft fitted in the body of the machine.

The forward or cutting stroke is operated by the pinion on a solid shaft, this revolves inside a hollow shaft upon which is mounted another pulley with the gearing for the backward stroke; as this return stroke is an idle one the speed is increased to three or four times that of the cutting rate by means of counter gears. The two pulleys are placed side by side and the belt is alternately thrown from one to the other by means of stopper pins fitted to the side of the table, these are adjustable according to the length of stroke required; the pins at either end of the stroke operate the belt-shifting forks through bell-crank levers. A loose idler pulley is provided for stopping the machine.

A pair of side columns support a crosshead having slide bearings upon which the tool box is mounted. The crosshead is raised and lowered by screwed vertical spindles working in nuts fitted in the crosshead, the motion is transmitted by a ratchet and pawl on one spindle and thence by mitre wheels and shaft to the other. The crossfeed is similarly operated mechanically, every stroke rotating the spindle through a certain angle according to the feed required.

The face of the tool-box swivels upon a bolt at its upper edge, so that on reversal the tool rises just clear of the work, and falls again into the vertical for the cutting stroke as the end of the job passes clear.

The shaping machine differs from the planer in that the table and work are fixed while the tool is moved forwards and backwards over the job. With the planer some considerable time is wasted at the instant of reversal, and putting a small job on a large machine proportionally increases this percentage of waste to total time occupied. The shaper drive is more positive, usually by crank or slotted cam, reversal is almost instantaneous, and the length of the stroke can be adjusted to within a fraction of an inch and that while the machine is in actual operation.

The tool is fixed at the end of a sliding beam, the length of this sliding stroke being adjusted by altering the throw of the crank, the transverse feed is obtained by ratchet and pawl action on a screwed spindle which moves the beam bodily along the bed of the machine. Vertical feeds are usually hand operated by means of a screw in the tool box or by raising the table.

The hobbing machine for cutting wheel teeth is constructed on the shaper principle, the tooth being formed by rotating the wheel blank in such a manner relatively to the path of the tool that the successive cuts form the shape of the tooth, these tools are however seldom met with in marine work, as the few gear wheels required can be bought cheaper in the outside market.

The planer being most suitable for long horizontal cuts, the shaper for shorter lengths, the slotting machine is adapted to vertical cutting, such as keyseating and cutting on arcs of circles. The motion is that of an inverted shaper and is obtained by means of a crank or slot cam through gearing, the stroke length depending on the crank throw. The height of the tool above the table is varied by raising or lowering the vertical beam relatively to the crank pin, after loosening the nut which secures the pin in the vertical slot of the beam. All the feed motions are operated on the table, in four horizontal directions at right angles, and also a circular motion for slotting curved surfaces, these being both hand and mechanically worked by gearing and ratchets.

With some machines the height of the tool box is adjnsted by making it the nut for a vertical screwed spindle so that it can be raised by rotating this screw. A qnick return motion is obtained for the idle upward stroke by means of an elliptical gear wheel, due to the difference between the major and minor axes.

For the machining of large surfaces, such as cylinder and column feet, the planing and slotting action sare combined in one machine. Such machines are of massive proportions, the soleplate being on the floor level, the bed is erected against the shop wall. A vertical column supporting the tool box is fitted to the bed and is moved bodily by a horizontal screwed spindle for planing. This column supports a similar spindle vertically which, threaded into the tool box, performs the slotting action. These two spindles are rotated by means of belt pulleys with gearing for quick return motion.

This leading screw principle is also applied to moderately large slotting machines, and has also been employed for the ordinary planer to supersede the rack and pinion, and, although it has the advantage that it obviates the lifting effect of the pinion, which gives rise to a slight rocking effect, its expense militated against general adoption. A similar expedient has been used where a short length of such a screw takes the place of the pinion, the rack teeth being formed obliquely to the longitudinal axis, so that the motion is that of a worm wheel.

* For Articles I. to XVIII., see previous issues.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Aberdeen Floating Dock.—On April 4th, there was launched from the yard of Vickers, Sons & Maxim, Barrow, a floating dock built to the order of the Aberdeen Harbour Commissioners. It is a Clark and Standfield's off-shore floating dock of 600 tons lifting capacity, and is for the Albert Basin in the port of Aberdeen. The pontoon is 150 ft. long, 42 ft. broad, and consists fundamentally of a pontoon, a single side wall and a double set of hinged side booms to attach to the quay wall. It is built entirely of wrought iron with the exception of the inside frames and shore-booms, which are of mild steel. The wall is 140 ft. long, 22 ft. high and 7 ft. wide, divided into four water-tight compartments, strengthened throughout by braced frames and bulkheads. The pumping machinery consists of an installation of horizontal centrifugal pumps driven by vertical electrical motors on the top of the wall in a teak house. The levers for operating the valves of the distributing pipes are all collected together and placed in a teak house above the motor house for the convenience of the operators. The dock was towed round by the North of Scotland by one of the Jolliffe tugs of Liverpool.

Odland.—On April 14th, there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel-screw steamer 231 ft. B.P. by 38 ft. breadth by 17 ft. 9 in. deep, having poop, bridge and topgallant forecastle, taking highest class at British Corporation, under special survey. The vessel is built to carry 1750 tons deadweight, and is of the single deck type. Accommodation is placed in poop for captain and engineers, with saloon aft fitted up in polished hardwoods, and for seamen and firemen in forecastle. The vessel has a large donkey boiler for driving the deck machinery, consisting of three steam winches, steam steering gear and direct steam windlass. The main engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 17½ in., 29 in. and 48 in. by 33 in. stroke, steam being supplied by a large boiler working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of Messrs. Fredriksen & Jobling, and during construction has been inspected by Mr. W. J. Jobling, of Newcastle. On leaving the ways the steamer was gracefully named *Odland* by Mrs. W. J. Jobling.

Penrose.—On April 14th, Messrs. William Doxford and Sons, Ltd., launched from their yard at Pallion a turret steamer to the order of The Penrose Steamship Co., Ltd. (R. B. Chellew, Esq., of Truro, manager). The vessel's dimensions are:—Length, 350 ft.; breadth, 49 ft., and depth, moulded, 26 ft. 6 in. She has a net tonnage of 2490 tons, and a deadweight carrying capacity of 6700 tons on a draught of 22 ft. 7½ in. Messrs. Doxford have supplied triple-expansion engines—25 in., 41 in., 66 in. by 45 in. stroke, and two large single-ended boilers to give her a speed of 9½ knots fully loaded. The vessel has been built to Bureau Veritas classification, and the superintendence of the building of the vessel on the owners' behalf has been in the hands of Mr. John Chellew, of Cardiff, and Mr. John David, of Porthcawl, South Wales. The launching ceremony was gracefully performed by Miss Flossie Spencer (daughter of Thomas Spencer, Esq., manager of Holborn Engine Works, South Shields), who named her *Penrose*.

Belle Ile.—On April 16th, Messrs. Osbourne, Graham and Co., launched from their yard at Hylton the steel-screw steamer *Belle Ile*, which they have specially constructed for Messrs. Fearnley & Eger, of Christiania. She is built on the single-deck principle, with all accommodation on bridge amidships, rooms for the captain and officers being very handsomely fitted out in hardwood and of large size. The vessel carries 3100 tons on a shallow draught, and is equipped with the most modern appliances for economical and quick working of cargo. She is built under special rules to Norske Veritas Survey. Water ballast is in both peaks and throughout double bottom, thus enabling the steamer to take long passages light, with the greatest safety. After the launch the steamer proceeded direct to Messrs. Geo. Clark, Ltd., Southwick Engine Works, to receive machinery and boilers. The vessel was gracefully christened by Mrs. Sand, wife of Captain Sand, of Christiania, who has superintended the construction of the steamer.

LAUNCHES—Scotch.

Hilary.—On March 31st, there was launched at Dundee, by the Caledon Shipbuilding and Engineering Co. the mail and passenger steamer *Hilary*, built to the order of the Booth Line, Liverpool, for their Brazilian trade. The new steamer is of the following dimensions: Length, 433 feet; breadth, 52 feet; depth to shelter deck, 38 feet; and gross tonnage, 6,300. She is of the shelter deck type, with spacious promenade deck amidships and boat deck above. Great attention has been paid to passenger accommodation, the appointments of the apartments for saloon passengers being particularly elaborate and complete. The first-class dining saloon, in which the full number of passengers may dine at one time, is situated on the main deck, and extends the full width of the ship. Accommodation for 350 third-class passengers is provided aft on the upper and main decks. A complete hospital is also fitted up. The machinery consists of two sets of triple-expansion engines. The vessel was launched by Miss Imogen Booth and named by Mrs. George Brocklehurst, Liverpool.

Salsette.—On April 2nd, there was launched at Greenock by Messrs. Caird & Co., the 6,000 tons twin-screw steamer *Salsette* for the P. and O. Company. The dimensions of the vessel are: Length, 456 ft.; breadth, 53 ft.; and depth, 32 ft. to spar deck. The builders will supply quadruple expansion engines of 10,000 indicated horse power, which will be capable of giving a speed of twenty-one knots. The *Salsette* will be engaged on the special mail service between Bombay and Aden. Wailes, Dove & Co.'s bitumastic enamel was applied to the bunkers.

Orcoma.—On April 2nd, there was launched at Dalmuir by Messrs. William Beardmore & Co. the twin-screw steamship *Orcoma*, which they have built for the Pacific Steam Navigation Company, Liverpool. The *Orcoma* has been specially designed for the company's mail service to the Pacific. Her general dimensions are: Length, 535 ft.; breadth, moulded, 62 ft.; depth to upper deck, 40 ft. 6 in.; gross tonnage, 11,500 Vessel and machinery have been constructed to Lloyd's highest class, and will be completed in accordance with the Board of Trade requirements. Accommodation has been provided for 250 first-class, 200 second-class, 100 intermediate, and 600 steerage passengers. The machinery consists of two sets of quadruple expansion engines, balanced on the Yarrow and Tweedy system, with cylinders of 26 in., 37½ in., 53½ in., and 76 in. diameter, by 54 in. stroke, and three double and three single-ended boilers for a working pressure of 210 lb., with all the most modern appliances for efficiency and economy. After the launch the steamer was berthed in the builders' fitting-out basin to receive her machinery and be completed for trial.

Columbia.—On April 2nd, there was launched at Port Glasgow, by Messrs. Russell & Co., the spar-decked steel screw steamer *Columbia*, which they have built to the order of Messrs. Fratelli Cosulich, of Trieste. The vessel is of the following dimensions: Length, 400 ft.; breadth, 52 ft.; depth, 30 ft., with a deadweight carrying capacity of 8,300 tons. She is built to Lloyd's highest class, and is intended for the emigrant carrying trade between the Mediterranean and North and South America. The machinery will be supplied by Messrs. J. G. Kincaid & Co., Greenock.

Lambare.—On April 2nd, there was launched at Pointhouse, by Messrs. A. and J. Inglis, a steel paddle steamer for South America. The dimensions of the vessel are: Length, 248 ft.; breadth over sponsons, 60 ft.; depth to hurricane deck, 27 ft. The vessel, which was named *Lambare* by Mrs. Inglis, Maybole, was moored at the builders' wharf to receive her machinery, which has been constructed by the builders. A sister ship is now on the stocks at Pointhouse for the same owners. Both vessels are being built to the order of Señor Nicolas Mihanovich, Buenos Ayres.

Itajuba.—On April 2nd, there was launched at Troon, by the Ailsa Shipbuilding Co., the twin-screw steamer *Itajuba*, built for the general cargo and passenger trade of Companhia Nacional de Navegacao Costeira, Brazil. The vessel, which is 270 ft. long between perpendiculars, 42 ft. beam, and 18 ft. 6 in. moulded depth, is built to Lloyd's special class, and has accommodation for a large number of first and second-class passengers. Two sets of triple-expansion engines are being supplied and fitted by the builders. The naming ceremony

was performed by Mrs. Morris, wife of Captain Morris, the owners' representative, under whose supervision the vessel has been constructed.

Prominent and **Nellie M'Ghee.**—On April 2nd, there were launched at Govan, by Messrs. Mackie & Thomson, two steam drifters for North of Scotland owners. Both vessels are of the same dimensions:—Length, 86 ft.; breadth, 18 ft. 6 in.; depth, 9 ft. 6 in.; and of 94 tons gross. Compound surface condensing engines of 200 i.h.p.—designed to give the drifters a speed of 9½ knots—are being supplied by Mr. W. V. V. Lidgerwood, Coatbridge. One of the vessels, owned by Mr. John More, Burghead, was named *Prominent*, and the other, owned by Mr. M'Ghee, Peterhead, was named *Nellie M'Ghee*.

Julian Alonso.—On April 2nd, there was launched at Montrose, by the Montrose Shipbuilding Co., Ltd., a steamer which has been constructed to the order of a Spanish firm in Havana, and is of 1600 tons displacement. The vessel is to engage in coasting in the West Indies, and has been designed for both passenger and cargo trading. The vessel was named *Julian Alonso*.

Killin.—On April 3rd, there was launched at Whiteinch by Messrs. C. Connell & Co., Ltd., the steel-screw steamer *Killin* for Messrs. Connell Bros., Ltd., Glasgow. The vessel has been built to Lloyd's 100 A1 spar deck rule, strengthened, and has a carrying capacity of about 6100 tons. She has been fitted with all the latest requirements for the rapid and efficient working of cargo. Triple-expansion engines will be supplied by Messrs. Dunsmuir & Jackson, Ltd., Govan.

Lupina.—On April 4th, Messrs. A. Hall & Co. launched from their shipbuilding yard at Footdee, Aberdeen, a steam drifter built to the order of Messrs. Leask & Buchan, Peterhead. The dimensions of the vessel are:—Length, 86 ft.; breadth, moulded, 18 ft. 6 in.; and depth (moulded), 9 ft. 9 in. She was named *Lupina*, and will be engined by the builders.

Fair Isle.—On April 4th, the John Duthie Torry Shipbuilding Co., Ltd., launched from their yard at Torry, Aberdeen, a steam drifter built to the order of Mr. George Walker, Fraserburgh. Dimensions:—Length, 84 ft.; beam, 18 ft.; and depth, 9 ft. 6 in. The vessel, which was named the *Fair Isle*, will be engined by Messrs. James Abernethy & Co., Aberdeen.

Redbreast.—On April 18th, there was launched at Pointhouse by Messrs. A. & J. Inglis, Ltd. for Messrs. G. & J. Burns's Irish mail and passenger and cargo service, the steamer *Redbreast*. The vessel is 277 ft. 6 in. in length, 33 ft. 6 in. in breadth, and 16 ft. 8 in. in depth. She will have triple-expansion engines, electric light, and all the most modern appliances. She will be registered 100 A1 at Lloyd's.

Melissa.—On April 18th, there was launched at Troon, by the Ailsa Shipbuilding Co., the steel-screw steamer *Melissa*, which they have built for Mr. John Kelly, Belfast, for service in the coasting trade. The dimensions of the vessel are:—Length, 167 ft. 3 in.; breadth, moulded, 25 ft. 10 in.; and depth, moulded, 12 ft. 9 in. The gross tonnage will be about 500 tons. Compound surface-condensing engines are being supplied by the builders, to give a sea speed of 10 knots. The naming ceremony was performed by Mrs. Kelly, wife of the owner.

Paringo.—On April 18th, Messrs. Scott, of Kinghorn (Limited), launched a large passenger and cargo steamer built to the order of the Adelaide Steam Shipping Company, Ltd., Melbourne. The vessel, which will accommodate a large number of first and third-class passengers, is intended for the owners' extensive coasting trade. She has triple-expansion engines by the builders and water-tube boilers for a working pressure of 255 lbs. On leaving the ways she was named *Paringo* by Mrs. S. C. Willimott, London.

Verdure and **Phingask.**—On April 18th, two steam drifters were launched from the yard of the John Duthie, Torry, Shipbuilding Co., Ltd. Aberdeen. Each is 92 ft. long, 18 ft. broad, and 10 ft. deep. They will be engined by Messrs. James Abernethy & Co., Aberdeen. One the *Verdure* is for Mr John S. Summers Peterhead, and the other the *Phingask* is for Mr. Edward Gordon, Fraserburgh.

LAUNCHES—Irish.

Verona.—On March 31st, Messrs. Workman, Clark & Co., Ltd., of Belfast, launched from their North Yard the second steamer built by them for the Steam Navigation Company "Italia" of Genoa. The interesting function was carried out in the most satisfactory manner and was witnessed by a large company of spectators, the owners being represented by Captain Falconi and Major-Engineer Lauro (Royal Italian Navy). The new vessel is named *Verona*, and has been specially designed for her owners' passenger service between Genoa, Naples and New York, and is 500 ft. in length with a gross tonnage of about 9500 tons. She has been built under the supervision of the British Lloyd's and the Registro Italiano for the highest class in the Registers and also conforms in all details to the regulations laid down by the Italian Mercantile Marine and the United States Department of Commerce. Special attention has been given, in the design and arrangement of the vessel, to the requirements of the American emigrant passenger trade, and no trouble has been spared in the endeavour to make her one of the most complete and comfortable vessels engaged in this service. The emigrant passenger accommodation occupies the greater part of the vessel, and is arranged in the bridge deck-house, poop and bridge spaces, and on the main and lower decks forward and aft, the sleeping berths being fitted two in height and arranged in blocks and affording accommodation for 2500 persons. Dining spaces, suitably furnished with substantial tables and forms, have been arranged in the bridge space, and on the main deck amidships. Accommodation for over sixty saloon passengers is provided in large state-rooms in the promenade deck-house. These rooms are placed along each side of the house and at the forward end a commodious dining saloon has been arranged with music saloon and lounge adjoining. The ventilation of all the passenger accommodation throughout the vessel, by natural and artificial means, has been very carefully considered, and will be found to be most satisfactory. A complete system of steam heating has been arranged throughout the saloon passenger accommodation, captain's, officers' and crews' quarters, while the emigrant spaces are warmed and ventilated on the thermo tank system, by which the atmosphere in each compartment can be changed eight times in the hour. The lavatory and general sanitary arrangements throughout are of the most complete character and include a complete system of drinking fountains with fresh and iced water supplies. The cargo space is divided into five spacious holds, each of which is provided with a large hatchway efficiently equipped with the necessary steam winches and derricks capable of handling a complete cargo with the greatest possible facility. The propelling machinery includes two sets of triple-expansion engines with all the latest improvements and auxiliary appliances, and three steel cylindrical double-ended boilers working under Howden's system of forced draught. The designing and construction of the vessel and machinery has been carried out under the direction and supervision of Mr. Garelli, naval engineer; Captain Roncallo, naval superintendent; and Colonel Squarzini, engineering superintendent of the Italia Company; Major-Engineer Lauro, of the Royal Italian Navy, and Captain Falconi.

Mercian.—On April 16th, Messrs. Harland & Wolff, Ltd., launched from their south yard the steel-screw steamer *Mercian*, a vessel of about 6500 tons, for the Wilsons and Furness-Leyland Line. The *Mercian* is a sister ship of the *Median* and *Memphian*, recently built at the same yard. The vessel has been built under Board of Trade survey for passenger certificate. She will have quadruple-expansion engines, and an installation of electric light, as well as the latest and most improved facilities for working ship and cargo.

TRIAL TRIPS.

Baro.—On March 23rd, the new twin-screw steamer *Baro*, built by Messrs. W. Harkess & Son, Ltd., of Middlesbrough, and engined by Messrs. MacColl & Pollock, Ltd., Sunderland, was taken for her official trials in Tees Bay. The machinery worked well, and a mean speed of 11 knots was obtained on a three hours' consecutive run under owners' conditions. This was deemed satisfactory, and the vessel proceeded to

Cardiff to load. She has been built and equipped to a full specification and Lloyd's class for Messrs. Elder, Dempster and Co.'s branch mail and passenger service on the West Coast of Africa, and will carry 1200 tons of cargo on a draught of 12 feet.

Kirkham Abbey.—On March 28th the *Kirkham Abbey*, the second of two steamers built by Earle's Shipbuilding and Engineering Co., Ltd., Hull, for the Hull and Netherlands Steam Ship Co.'s Continental Service, was taken on her official trial, when a mean speed of nearly half a knot in excess of the contract was maintained for a distance of 200 miles. The trial throughout was most satisfactory, the machinery working without the slightest hitch during the whole of the run, ample steam being supplied by the boilers.

Hock Lee.—On March 31st, the *Hock Lee*, built by Messrs. Bow, M'Lachlan & Co., Paisley (of which we gave particulars in our April issue, page 382), ran trials on the Firth of Clyde. Notwithstanding the stormy weather which prevailed, the steamer behaved admirably, and the speed attained with the vessel fully loaded was in excess of contract requirements. The owners were represented at the trial by Messrs. Muir and Tilston, under whose supervision the vessel has been built.

Heath Bank.—On April 1st, the steam herring drifter *Heath Bank*, of Aberdeen, built by Messrs. J. and G. Forbes, Sandhaven, and engined by Messrs. Menzies & Co., Ltd., Leith, to the order of Messrs. J. Geddes & Co., Aberdeen, ran her official trip in the Firth of Forth, when a speed of $10\frac{1}{2}$ knots was obtained. The owners and builders were highly satisfied with the result.

Principe di Udine.—Lately, the new Italian steamer *Principe di Udine*, built by Messrs. Barclay, Curle & Co., Whiteinch, for the Lloyd Sabaudo, of Genoa, ran successful trials in the Mediterranean. She ran preliminary trials on the Clyde, but her official trials, like those of her sister ship *Tomaso di Savoia*, built by the same firm, took place in Italian waters. The *Principe di Udine* attained a speed of 18·20 knots, the highest yet run under the Italian flag.

Cariboo.—On April 9th, the trial trip of the T.S.S. *Cariboo* was run on the Firth. The vessel has been built at the Ayr yard of the Ailsa Shipbuilding Co., Ltd., of Troon and Ayr, for service in British Columbian waters. She is handsomely fitted up for passengers, and has also limited hold accommodation for light cargo. The vessel is fitted throughout with electric light, searchlight, steam heating, and all modern appliances for the comfort of the passengers, and to meet the special requirements of the service in which she will be engaged. Twin engines, triple-expansion, have been constructed by Messrs. MacColl & Co., Ltd., Belfast, and on the measured mile the speed obtained was materially in excess of the guarantee, the engines working with great smoothness and giving every satisfaction. During construction the vessel has been under the supervision of Mr. James Maxton, naval architect and consulting engineer, Belfast.

St. Andrew.—On April 13th, the new triple-screw turbine steamer *St. Andrew*, built by Messrs. John Brown & Co., Clydebank, for the Fishguard and Rosslare service of the Great Western Railway Co., ran trials on the Firth of Clyde. The results were highly satisfactory. The vessel steamed easily, and on four runs between the Cloch and Cumbrae, with and against the tide, she attained a mean speed of 23·03 knots, this being fully half a knot over the contract speed. The machinery worked with great smoothness, and a feature of the trial was the equality of the revolutions maintained in the various turbines. The *St. Andrew* is 350 feet in length and of 2,520 tons gross. The owners were represented on the trials by Mr. Charles T. Ramsay, under whose supervision the vessel has been designed and constructed, and Mr. C. Irvine Davidson.

Hesperian.—On April 16th, the new Allan Line 10,000 ton twin-screw steamer *Hesperian* ran her official trials on the Clyde, and her performances were highly satisfactory, both to her builders and her owners. The *Hesperian* is the second steamer of her class recently built by Messrs. Alex. Stephen and Sons, Ltd., of Linthouse for the Glasgow-Canadian service of the Allan Line. Her sister ship, the *Grampian*, was completed and took her place in the service in the autumn of last year. It is recognised that the Atlantic passenger service demands now-a-days a higher type of ship, alike in size, speed and comfort than was deemed necessary a few years ago. This requirement these two fine steamers, together with a sister twin-screw steamer the *Ionian*, and the *Pretorian*, are designed to supply. They are to be employed, as we have said, in the Glasgow section of the Allan service in supplement to their mail service out of Liverpool, in which their turbine and other high-speed steamers are employed. The *Hesperian* is 502 ft. in length, 60 ft. in breadth and 41 ft. 6 in. in depth to shelter deck, and is built to the highest class of the British Corporation. Accommodation has been provided for 200 first-class, 350 second-class and 1400 steerage passengers. For the two first named, large and well-appointed saloons, dining rooms, libraries, lounges and smoke-rooms have been constructed. The public rooms are very tastefully panelled in white enamel, fumed oak, mahogany and other hard woods, with which the sleeping rooms are in keeping. The third-class accommodation is of the most up-to-date character, in pitch pine and other woods. The *Hesperian*, like her sister ship, is designed to maintain a speed at sea that will enable the passage between Glasgow and Quebec to be made in less than seven days. She left Glasgow on her maiden trip to Quebec and Montreal on Saturday, 25th April, and is intended to sail at regular fortnightly intervals with the *Grampian* throughout the season. These two fine new steamers, which are the largest and fastest that have ever been engaged in the trade, will, along with the twin-screw steamer *Ionian*, and the screw steamer *Pretorian*, sailing on the intervening weeks, provide a weekly express service from Glasgow to Canada for passengers and cargo. On the measured mile the *Hesperian* attained an average speed of $16\frac{1}{2}$ knots an hour, very considerably in excess of what is necessary to perform the voyage within the time specified. The owners were represented at the trials by Sir Nathaniel Dunlop, chairman of the Allan Line Steamship Co., Ltd., and by Mr. Henry Allan and Mr. James A. Allan, Mr. A. E. Stephen, Mr. F. J. Stephen and Mr. Matthew Hunter represented the builders.

Lady Fraser.—On April 17th, the pilot cruiser *Lady Fraser* (of which we gave particulars in our April issue, page 382), built by the Fairfield Shipbuilding and Engineering Co., from designs by Professor Biles, ran trials on the Clyde. The contract speed was exceeded by one and a quarter knots on the measured mile and by half a knot on the long trial.

Martha Washington.—The twin-screw steamer *Martha Washington*, which has been built by Messrs. Russell & Co., Port Glasgow, for the Austro-Americana and Fratelli Cosulich, Trieste, ran trials on the Clyde in the third week of April, when a mean speed of 17 knots was attained. The vessel, which is of about 8500 tons gross, is intended for the passenger and emigrant trade between the Adriatic and Mediterranean ports and New York. She has accommodation for sixty first-class and 130 second-class passengers, while the whole of the available space on the upper and lower 'tween decks is fitted for the accommodation of 2000 emigrants. Messrs. Matthew Keenan & Co., Ltd., have completed all the boiler and pipe covering on the vessel.

THE New Zealand section of the Australasian Institute of Marine Engineers proposes to erect a building on a freehold site which has been obtained in the city of Wellington for the purpose of holding meetings in, and utilizing for the official work of the institute. With the object of securing the cooperation of members and friends, a circular has been issued inviting all to take up shares in the undertaking, each share being of the value of one pound, to be paid by instalments extending over a period of twelve months. The shares are to yield no interest, but are to be repaid as soon as the state of the funds admit ; in the event of the death or removal from New Zealand of the shareholder the amount of his holding will be returned. We note that Mr. Archd. Denny has taken up one hundred shares. We commend the marine engineers of the Dominion for their enterprise and self-denying zeal for the good of their cloth. The proof of true love is found in self-sacrifice, and a friendship which is only formed for material gain and freezes when a little self-denial is required, is unworthy of the name and the love which an engineer ought to have for his work and the friendship he ought to entertain towards his profession, should lead him to support and further the advancement of a society established to uphold the dignity of the science and art necessary in his life work.

OBITUARIES.

Mr. Geo. A. Harris.—It is with deep regret that we have received intimation of the death through heat apoplexy of Mr. Geo. A. Harris, chief engineer of the Orient Royal Mail Steamship *Omrah*, whilst on a voyage from London to the colonies. Mr. Harris, who only joined the *Omrah* in February of this year, was formerly chief engineer of the same company's steamer *Orient*, which he left about a year ago, owing to illness, when he obtained leave of absence. It is very sad that he should have been cut off so soon after resuming duty, as it was hoped that he had been completely restored to health again. Mr. Harris was comparatively speaking a young man. He was born at Greenwich in 1860. He served his apprenticeship with Messrs. John Penn & Sons from 1876 to 1881, and remained with them two years after the expiration of his apprenticeship, joining the Orient Co. in 1883 as junior engineer in the *Cusco*, from which he rose to the position of second engineer of the *Chimboraso* in 1890, then to chief engineer of the *Lusitania* in 1896. He was transferred to the *Austral* in 1898 and to the *Orient* in 1903. Mr. Harris was a man who took great interest in his profession and was very highly respected by his employers and all who came in contact with him, and his death will be very deeply regretted by a wide circle of friends. Mr. Harris was one of the early members of the Institute of Marine Engineers, and was one of the engineers who received the King's decoration for services in connection with the transporting of troops during the South African War.

Photo by The Exchange Studios, Sydney, U.S.A.

Geo. A. Harris.

Mr. Andrew Gibb.—The death of Andrew Gibb on April 3rd has removed from a large circle of friends and admirers one whom it was a pleasure to know and esteem, not only as an engineer who knew and understood his business, but as a man whose wide sympathy and generous nature betokened him to be one of the true and good sort. Born at Glasgow in 1850, he served his apprenticeship with Messrs. Barclay, Curle & Co., and after some sea experience he left the engine-room for a position as draughtsman with a firm of engineers at Millwall. Soon after the late Mr. H. M. Rait founded the firm of Rait & Gardiner, Mr. Gibb became works manager and ultimately managing partner; since then the operations of the firm have been considerably extended, and the work executed has been considerable, especially in connection with ship repairs due to damage by collision or otherwise—cases which require a quick eye and discernment to gauge the probabilities in estimating the costs. Having branches at Millwall, Cubitt Town, Albert Dock and Tilbury, the firm had a wide area of interest to be controlled. Mr. Gibb was a member of several societies and a vice president of the Institute of Marine Engineers, with which he was associated from the beginning of its course. He was the sponsor on behalf of Mr. Maginnis—the author of the first paper read before the members—and who was at that time a partner in the firm of Rait & Gardiner. Mr. Gibb was an alderman of the borough of Greenwich, and his capacity for business was highly esteemed in the Council chamber. His liberality was great and the services he rendered both to the municipality and the surrounding district have left records which will remain as memorials of his generosity. Of St. Mark's Presbyterian Church in Greenwich he was as a pillar of support, and the testimony borne by the minister of that church on the day of his funeral was echoed by the large gathering present at the service, representative of the church, the Greenwich Borough Council, the different branches of the firm in which he was an honoured partner and the many private and business friends. To his widow and relatives also the words of the Rev. Geo. Elder would prove of signal help in the day of their grief and sorrow.

Photo by Lambert Weston & Son, Folkestone.

Andrew Gibb.

Mr. George McFarlane.—We have to record with regret the death of Mr. George MacFarlane, of Messrs. A. R. Brown, McFarlane & Co., consulting engineers and naval architects, Glasgow, which took place on April 6th at his residence, Dunsloy, Bellahouston, the cause of death being peritonitus. Deceased, who was well known and much esteemed in engineering, shipbuilding and shipping circles, was born in Glasgow about sixty-two years ago. Having completed his education, he was apprenticed in early youth to Messrs. James and George Thomson, Clydebank now Messrs. John Brown and Co., Ltd. After the customary period of training in these large works, he entered the service of the Cunard Company, and sometime thereafter became superintendent engineer to the State Line. On the steamers of that company being acquired by the Allan Line in 1891, he entered into practice on his own account as a consulting engineer and naval architect, in which he was highly successful. When the British Corporation Registry of Shipping was formed in Glasgow, he became chief engineer-surveyor to that concern. For leading Glasgow firms he designed and superintended the building of steamers, and was frequently commissioned by the Japan Mail Steamship Co. to superintend the construction of steamers for their large fleet. In 1900, the Glasgow agents of the Company floated the business under the Limited Liability Companies Act, and Mr. McFarlane became the managing director

of the engineering department. The firm traded under the title of Messrs. A. R. Brown, McFarlane & Co., agents of the Japan Mail Steamship Co. Japan merchants and consulting engineers, and also discharged the duties of the Consulate of Japan. Mr. McFarlane was a member of the Institute of Mechanical Engineers, of the Institution of Naval Architects and of the Institution of Engineers and Shipbuilders in Scotland. On the council of the latter body he acted for some time, and a few years ago he was selected to serve as a member of the Consultative Committee appointed to confer on a number of technical matters with the Marine department of the Board of Trade. Deceased never took any very great public interest in Glasgow civic affairs, but at the seaside watering-place of Innellan where he was a familiar figure, he took a leading part in schemes affecting the district, and his work in this respect was recently recognised by his election as a member of the County Council of Argyll.

REVIEWS.

British Engineering Standards Coded Lists, issued by authority of the Engineering Standards Committee. Vol. V., 25s. Structural Steel for Shipbuilding and Marine Boilers. Steel Castings and Forgings for Marine Purposes. Marine Code compiled by James Adamson, Hon. Sec. Institute of Marine Engineers.

The British Standard Marine Code is compiled by that well-known marine engineer, James Adamson, and may well be called a practical code by a practical man ; it is designed for the use of shipowners, ships' officers, shipbuilders, marine engineers and all those handling marine material, whether afloat or ashore. The latest details in all the various matters coming within the scope of modern marine engineering are carefully and systematically dealt with ; and as the compiler has had a long experience of requirements for ships under various circumstances, he has incorporated the results in a most convenient form for ready reference by every one whose duty or interest lies in the direction of shipping and ships sea or river navigation. The code is divided into sections with great judgment, and the index itself is a useful compilation for general service by all those whose business is connected with water-borne traffic. The ship is dealt with in a great many varied circumstances, of location, of suitability for cargoes, of damage and repairs, under conditions derived from experience, including dry docking and surveying necessities or requirements. The machinery in all details of latest equipment of turbine, water-tube boilers, forced draught, hydraulic, electrical, refrigerating, steering gear and deck machinery are treated fully for repairs in all cases where found necessary. As a sample of the subjects covered under the title of main engines, may be noted Simplex type, compound type triple-expansion type, quadruple-expansion type, reciprocating and turbine combined type, turbine type and internal combustion gas type. In addition to the propelling machinery, all inner machines, such as evaporators, feed-water filters, and feed water heaters, are also treated fully, with phrases for reporting conditions of machinery, details, repairs, or renewals required, also ordering phrases for material connected with boilers and machinery, whether propelling or auxiliary. The propellor under every circumstance is dealt with ; and with the assistance of a convenient sketch a shaft can be ordered by telegram in full detail or dimensions confirmed. The turbine has a section to itself and is given in minute particulars for all classes of repairs. The diagram for the location of turbine units, together with the phrases, will be found most useful. This code appears to be as complete as experience and industry can make it, and the Standards Committee are to be congratulated on their selection of the compiler, whose system of work is clearly defined by reference to the code under the title "Execution of Work." "In all the work and details which are being undertaken for us, please note that the material must be good and reliable and the workmanship of a first-class character, in order that the capital expenditure may not carry with it a heavy interest in frequent repairs and renewal of details." "We do not believe in, nor do we in practice carry into effect, the idea that cheap material or workmanship is good either for buyer or seller. It burdens the one and damages the reputation of the other." "In all the work you have undertaken for us, please keep in special view in the designing and arranging the details, that these require to be overhauled and re-adjusted smartly from time to time. It is thus a merit on the part of the designer so to arrange details, as to facilitate the work of the engineer, who has to deal with them in practice." "In all the details of the work to be undertaken, please keep in view that the British Engineering Standards are to be adhered to throughout." There are also phrases for dealing with the purchase of steamers and the conditions of such as are offered for sale ; these will be found useful to surveyors, prospective buyers and sellers. For instance, dealing with the result of an inspection of machinery for a possible buyer, the following phrase may be quoted : "Surveyor recommends that as the ship is now—— years old, she ought to undergo special survey in order to retain her class. This would involve an expenditure of about £——. The condition otherwise is reported to be, hull ——, machinery ——, so far as can be seen." The advantages in using the British Engineering Standards are rapidly becoming known to all those who have renewals and repairs to carry out at short notice. The standard pipe flanges alone have made a complicated business very simple, and an endless variety of sizes are now reduced to a comparatively small number. In the same way the code will become a standard code for marine engineers, shipbuilders and shipowners. Besides the marine code, this volume contains coded list of the British standard sections and specifications for structural steel for shipbuilding, structural steel for marine boilers, ingot steel forging and steel castings for marine purposes. The great value of a good index in saving time and temper is well known, this has evidently been kept in view by the compiler of this code. Telegraphic phrases are also suggestions for repairs and renewals and induce thought in time of turmoil when about to report accidents or order replacements. The various Classification Societies and Underwriters will find the phrases of value where damage to ship, cargo and machinery are dealt with in detail and reports of surveyors with suggestions, and possibilities regarding repairs and detentions are put in handy sentences. The Refrigerating Machinery section is very fully detailed, due to the importance of the carriage of frozen cargoes. As a matter of interest this volume contains a short history of the Engineering Standards Committee supported by the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects, the Iron and Steel Institute and the Institution of Electrical Engineers : this deals with the origin, the scope and the work of the various committees. For reference it is useful to find a list of the publications of the Engineering Standards Committee.

Marine Boiler Management and Construction (12/-). By C. E. Stromeyer. Third edition. London : Longmans, Green and Co. 1907.

The author's position makes such a work as this of great value and it is of a character that commends itself, beginning as it does with boiler management and going into detail very closely, with adequate sketches in every case. Collapsed crosses of furnaces are dealt with, for instance, and tube plate troubles. Another point mentioned is the patching of boilers, where this is most likely to occur. Corrosion and pitting is a subject closely dealt with here and certain to prove of great value to all those concerned. The reasons are fully discussed, while the questions of fuel and combustion also receive very close attention. The subject of strengths of materials, which is generally rendered rather dry, is here made, we think, attractive. Mechanics is another branch treated in the same way, but with special regard to boiler design particularly. We then come to construction notes, with the tools employed. The author is very graphic as to bending, riveting, flanging and all the various processes the plates have to go through in the formation of boilers, finishing up with the measuring of deformations. In his concluding chapter, he treats of design and shows the considerations which rule here. He naturally gives Lloyd's and Board of Trade Rules on which this matter is based. At the end is a very good index. We consider such a work is certain to continue to receive that support it has hitherto done for many reasons. In the first place, the author is master of the subject and in great detail he gives authority for all his information and supplements this by his own practical experience. Added to this, his explanations are fully illustrated everywhere.

Sea Terms and Phrases—(English-Spanish and Spanish-English). 3/6. By Graham Hewlett, R.N. London: Chas. Griffin & Co., Ltd. 1907.

We here have a small pocket book which we think should prove useful to sailors frequenting Spanish ports, or, indeed, anyone having to do with Spanish shipping in any form. The author has evidently made a complete study of the language and his maritime dictionary should prove of great use to those for whom it is intended. It is often desirable that technical terms should be translated, and here we have the very opportunity for which there must often be the need and which would bear repetition in other languages. Though particularly useful for naval officers, from an examination of the terms we find the mercantile marine is also provided for, and we find also such engineering details as pumps of sorts, though we do not notice such a one as centrifugal mentioned. However, it must be remembered, it is the sailor's dictionary and not intended for engineers as such. We think it will prove valuable and be an aid in bringing Spain and England closer together in the maritime direction. Its novelty will ensure that.

The Modern Machine Shop. By Rankin Kennedy. Vol. III. London: Caxton Publishing Co. 1908.

This volume is uniform in size with all from the same author and publishers and in this case deals with grinding tools, milling and planing machines first. We find full illustrations of these machines, photographs for the most part, though in the case of wheel gear cutting there is not wanting the necessary drawings to explain the tooth action and its shape. The many details of milling machines are found here in every variety. The names of the machines where given show them to emanate from the United States and Germany, in many cases manufacturers here probably not being disposed to make their designs too public. The chapter on gears is an interesting one, whether of wheels, couplings or chain belts. Motive power for machine shops is another interesting chapter and here we have engines, steam of various kinds and gas. Then electric motors naturally claim attention in this connection. They are shown for drills, planers, punches, lathes and driving shafting. This volume contains a fund of information of a popular character and we may assume, therefore, will be of value to many engineering students accordingly.

Superheat, Superheating and their Control. (6/-). By W. H. Booth. London: A. Constable & Co. 1907.

This subject has, of course, in recent years received some prominence and the author goes into questions of cylinder action to show necessity for superheat. There is the saturated steam to begin with. We then see the drawbacks of superheat for reciprocating engines and the difficulties of application to marine boilers. With turbines there are no rubbing surfaces, but blade stripping has been attributed to this cause. The Corliss gear is said to be better for superheat than the ordinary slide valve, and the author goes into the question of controllable superheaters and several forms are shown. The advantages of the application are given in land and locomotive boilers. The conclusions drawn are that superheating is a thorny subject and though gain is claimed it is by no means of a positive character. To those interested this book is of considerable value however.

Thermo Dynamics of the Steam Engine. (21/-). By C. H. Peabody. Fifth edition. London: Chapman & Hall. 1907.

This work may be said to be a good example of the science of the steam engine. A knowledge of the calculus is necessary, but for those with the proper education there is undoubtedly a treatise here that embraces all that is required. It is scholarly and practical for its purpose. The thermodynamics of the steam engine is made interesting to a degree, the adiabatic curve being clearly explained and what entropy is. Every real student of the steam engine should have this book before him for reference. The author also sets questions at the end of each chapter. Carnot's cycle for steam engines is clearly explained and these lead up to actual engines and their design from diagrams. The author then goes on to compound engines of various types in the same way and applies his deductions to vessels of the United States navy. He has a chapter on instruments, such as indicators and calorimeters and discusses various influences, such as cylinder walls on the action of the steam. In economy, he gives the results of many trials and notes the effects of different effect. Friction is a subject closely studied here. The author goes also closely into internal combustion engines and illustrates by many types and devices. The subject of compressed air precedes that and leads up to refrigerating machines with tests of different varieties. The chapter on turbines is the best as to the science of the matter we have seen anywhere and would in itself aid the circulation this volume has attained. It concludes with a test of a Parsons type machine. We think we have mentioned sufficient to show the value of this work, which is of a high order.

The Statute Law relating to Patents of Invention and Registration of Designs. By I. W. Gordon. Messrs. Jordan & Sons, Ltd., London.

This book is a compilation of the Statute Law relating to Patents for Inventions and Registered Designs in the form of a code, and in view of the recent important changes in this branch of the law the book comes as a useful addition to the technical library of a professional man, as well as a valuable treatise to lay members of the public. Those who have had the opportunity of studying the two previous works by the same author, *viz.*, "Monopolies by Patents" and "Compulsory Licences under the Patent Acts," will look for the skilful treatment of the subjects exemplified therein, exhibited in the book under review, and in this they will not be disappointed. The author has wisely left out of consideration those factors which are already so well crystallized and subject to no sudden changes, *viz.*, the Common Law and the Case Law, and has confined himself to the provisions of the new Act involving changes of practice, variations of procedure, modification of rights and variations in responsibility of patentees. The work contains a tabular synopsis of the present Act, and each heading is then sub-divided into sections with specific reference to the section or sections involved in each case. The 1907 Act is printed in full and the International Convention is given *in extenso*, which, together with the index at the end of the book, enables the reader to readily compare the sub-divided points in the synopsis with the section of the Act dealing with it. The Statutory Rules, Orders and Forms issued under the new Act were not completed when the present volume was going to press, and have been comprised in a supplemental volume to this work at a cost of 1s. 6d.

PARAGRAPHS.

In our last issue we referred to the new line of steamers which has been inaugurated under the name of The New York and Continental Line with a fleet of four steamers; one of those named, the *Jelunga*, formerly belonging to the British India Co., and built by Messrs. Denny Bros., was fitted out for third-class passengers by Messrs. Lester and Perkins, engineers and shipwrights, Royal Albert Docks, the electric lighting in the various compartments being entrusted to Messrs. Grinyer & Co. The *Jelunga* left the Royal Albert Dock on April 9th under charge of Captain Walker. The chief engineer, Mr. Cornell, was formerly second engineer in the service of her late owners.

Referring to the figures which have been given to show the results of a voyage of the *Lusitania* across the Atlantic, it is interesting to notice a comparison between the performances of other steamers on a similar basis, although not on the same route. The formula taken in each case is the following:—

$$\frac{\text{lbs. of coal per day under weigh}}{\text{Displacement in tons} \times \text{miles per day.}}$$

The *Lusitania* may be taken approximately from what appears to be about her best performance for one run, giving an average of 580 miles with a displacement of 36,000 tons = ·11145 lbs. per ton displacement per mile. A steamer built about twenty-five years ago and fitted with compound engines, boiler pressure 80 lbs., gave on an average day's run, including ports of call during the voyage and the consequent manœuvering, a speed of 252·75 miles with a displacement of 7,580 tons = ·0528 lbs. per ton displacement per mile. Another steamer, built about twenty-two years ago and fitted with

compound engines, boiler pressure 90 lbs., gave an average of 263·4 miles per day with a displacement of 8,700 tons = ·05018 lbs. per ton displacement per mile. Coming now to the triple-expansion engines and the higher steam pressure, a steamer built about seventeen years ago, fitted with triple-expansion engines, steam pressure 150 lbs., gave an average of 288·7 miles per day, with 9,760 tons displacement = ·0409 lbs. per ton displacement per mile. Another steamer, built about sixteen years ago, fitted with quadruple-expansion engines, boiler pressure 180 lbs., gave an average of 271·27 miles per day, with a displacement of 8,620 tons = ·04073 lbs. per ton displacement per mile. Still more recently, with a further increase of boiler pressure to 200 lbs., a steamer fitted with twin-quadruple balanced engines has given an average of 307·1 miles per day with a displacement of 12,500 tons = .0299 lbs. per ton displacement per mile. These figures, based on actual voyage results show the progress which has been made during the last twenty-five years. The increase in steam pressure and in the carrying capacity are marked by great advances and in respect to the latter, we are apparently on the eve of still further advancement. The coal consumption, due to the speed, mounts up considerably with the reciprocating engine and in this respect, the turbine has the advantage. The consumption due to increased displacement does not increase in a high ratio when the form is maintained on normal lines, so that increased carrying capacity is in the direction of economy in working expenses relatively to cargo carried. There is great room for improvement in the boiler and stokehold appliances, so that more may be got out of the fuel, and we quite recognise that the discussions and papers which are being brought before marine engineers on the subject will lead to improvements being made in respect to a better utilisation of the products of combustion. It may be also noted that while Welsh coal was used to a much greater extent some twenty years ago than it is at present in the merchant service, the further factor of a cheaper quality of coal may be entered for consideration when drawing the comparison between the results of the various types of steamers cited.

Institution of Engineers and Shipbuilders.—An extraordinary general meeting of this body was held in the Institution Rooms, Bath Street, Glasgow, on the 31st ult.—Mr. John Ward, president, in the chair—when the following office-bearers were nominated for the ensuing session:—President, Mr. John Ward; vice-presidents, Messrs. W. M. Alston, and W. W. Lackie; members of council, Messrs. Thomas Bell, J. Howden Hume, J. Foster King, A. S. Lorimer, R. A. Maclaren and (from the Associate section) Mr. Thomas Whimster. Afterwards Mr. Henry A. Mavor's recent paper on "Electric Propulsion of Ships, with notes on Screw Propellers," was discussed at some length, the following members taking part:—Messrs. E. Hall Brown, W. P. Sawyers, Campbell Macmillan, E. M. Speakman, J. A. Rudd, J. R. Jack, Professor Jamieson, Professor Biles and Messrs. T. Tonides, James Hamilton, R. T. Napier and L. Macbrayne. The discussion generally was from two standpoints, first, that of the electrical engineer, and second, of the marine engineer and naval architect. The speakers on the electricity side were unanimously complimentary to the author for the ingenuity distinguishing his arrangement of gear and his large mindedness in laying the result of his labours and thought before them. The speakers from the marine engineering and shipbuilding side on the whole thought well of the proposals laid before them, and spoke encouragingly of Mr. Mavor's efforts to solve a problem which had incalculable possibilities in the way of progress in ship propulsion. A paper by Mr. W. C. Martin on "The Electrical Equipment of the Cunard Express Steamer *Mauretania*" was taken as read.

Messrs. Simpson, Strickland & Co., Ltd., the well-known yacht builders of Dartmouth, have been successful in obtaining the order for a very remarkable high-speed steam yacht. The boat is to be built of steel and to be 130 ft. in length, and is to be fitted with two sets of the firm's triple-expansion machinery and two water-tube boilers. The conditions of the contract call for a speed of forty kilometres, that is, 24·85 miles in the hour on a four hours' trial, so that the boat will be one of the fastest yachts in the world. She will have a straight stem and slipper stern, being, of course, cut away under the water line aft. Two pole masts and two funnels will be fitted, with a deck house forward, and four staterooms, saloon, bath-room, etc., aft, under a raised poop deck, and she should present a very smart appearance. It is interesting to note that the owner is M. Jellinek Mercedes, the owner of the factory where the famous Mercedes cars are made. M. Jellinek has also built and owned a number of very fast petrol-engined boats. The present boat is required for short trips in the Mediterranean to ports lying about 100 miles from Nice, where he resides. It is very satisfactory to note that an English firm has been successful in obtaining this foreign order, the builders having specially laid themselves out for high-speed steam craft of all descriptions.

Delivery of the Fastest Warship in the World.—On the termination of the very severe series of trials which she has satisfactorily undergone, H.M.S. *Tartar*, the turbine torpedo boat destroyer built by Messrs. John I. Thornycroft & Co., Limited of Southampton, was finally inspected by Rear-Admiral MacGill, Admiral Superintendent of Contract-built Ships, on April 15th. The *Tartar* is the fastest warship afloat, its speed on the official trials being 35·672 knots as a mean of six runs. During six hours' run the mean speed proved to be 35·363 knots, while the fastest run was at the rate of over 37 knots. The speed guaranteed by contract was 33 knots. The vessel is 270 ft. long, the propelling machinery being Parsons turbines and six Thornycroft water-tube boilers. Both machinery and boilers were constructed by Messrs. Thornycroft. The armament consists of three 12-pounder guns and two torpedo tubes. The vessel has now been taken into commission by the Fleet Reserve, and will be stationed at Sheerness, where the wireless telegraphic apparatus will be fitted forthwith.

Messrs. S. T. Taylor & Sons have supplied their "Tynos" patent removable asbestos mattresses for three boiler bottoms in the s.s. *Waitemata*, and carried out insulation work in s.s.'s *Westerwald* and *Spreewald*.

A New Metallic Mirror for Searchlights.—Ever since the introduction of searchlights for battleships attempts have been made from time to time to substitute metallic mirrors in place of glass ones, which are unsatisfactory due to the fact of their being so readily broken by concussion when firing the guns, and that the silvering at the back of the mirrors is very liable to blister and leave the surface of the glass. The difficulty of making true parabolic mirrors has been overcome by The Cowper-Coles Electrolytic Process, which briefly consists of depositing by chemical means on the convex side of a glass former or mould a thin silver film and then spinning the former in an electrolytic cell charged with copper anodes and a copper electrolyte so as to deposit the copper on the silver surface, the process being continued until the silver film has received a sufficient thickness of copper to give the desired rigidity to the parabolic mirror. The glass mould and the electro-deposit are then removed from the depositing cell and placed in a vessel containing cold water, the temperature of which is gradually raised until the expansion of the copper is sufficient to cause the metallic mirror to leave the glass former. The silver-faced mirror thus produced has as highly polished a surface as glass and is finally subjected to an after-treatment to prevent the silver from tarnishing, and is then mounted in a metallic ring (which fits in the projector case) provided with knife edges which firmly grip the edge of the mirror without distorting it. A large number of mirrors made by this process have been supplied to the British Government, some of which were sent out to the South African War. Mr. Cowper-Coles is now introducing a new metallic mirror which is only partially made by electro-deposition. The mirror has a surface composed of alternate bands or rings of gold and white reflecting surfaces, which it is claimed give a more penetrating beam of light both at night and in foggy weather. Objects on which such a beam of light is thrown stand out in greater relief than in a light thrown from a silver white metal mirror, and the intensity of the light is so great that it is impossible to aim accurately at the projector. Another great advantage of the new mirrors is that they are not fractured by concussion, and even when penetrated by bullets the area of distortion is very small.

The Junior Institution of Engineers.—Through the munificence of Mrs. Frank R. Durham, a bursary of the value of £25 per annum, to be called after the chairman of the

Institution, the Durham Bursary, is about to be announced to members and associates, of whom those between the age of the twenty and twenty-two will be eligible to compete by writing a thesis on some technical subject chosen by the candidate. The first award will be made in October, and competing theses must be in the hands of the secretary at 39, Victoria Street, Westminster not later than the 1st September next.

THE business of a nation cannot remain at a standstill. "Le roi est mort, vive le roi." Yet the finding of a National Court with experts to indicate the law may be delayed till the circumstances of the case are well nigh forgotten by the public, and the business of those more immediately concerned hampered considerably. We are pleased, however, to see at last an announcement that the high court in Russia has adjudicated to the British India Co. the claim made for the value of the *Ikona*, sunk by deliberate intention with a cargo of rice on board, on the presumption that it was contraband of war for the Japanese.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class, 2C Second Class

March 7th, 1908

Anderson, Jas.	1C	Glasgow
Ball, William R	1C	London
Barbour, Hugh	1C	Glasgow
Barrie, William	2C	Glasgow
Bate, Llewn. C	2C	Cardiff
Beattie, Thomas	2C	Belfast
Benson, W E	2C	Liverpool
Bevan, Evan W	1C	Cardiff
Blanch, William	2C	Leith
Blowfield, B C	2C	London
Burgess, Henry	1C	N Shields
Coughlin, E. J	2C	Cardiff
Devonport, J H.	2C	N Shields
Dickman, Edgar	2C	Glasgow
Downes, Harry	2C	South'ton
Duddy, Robert	1C	Belfast
Edmunds, T. H.	1C	Cardiff
English, W. M	2C	London
Flenley, Arthur	1C	Liverpool
Franklin, Harry	1C	N Shields
Gillan, Samuel	2C	Leith
Halliday, L. G	1C	Liverpool
Hamilton, Allan	1C	Glasgow
Hughes, Wm . .	1C	Cardiff
Jamieson, Wm	2C	Glasgow
Lawrence, C W	2C	Falmouth
Little, George . .	2C	Liverpool
Lynd, Ernest C	2C	Belfast
Mackie, L	1C	London
Mair, Andrew . .	1C	Glasgow
Mason, William	2C	Cardiff
M'Clelland, H	1C	Liverpool
M'Ghie, Robt.	1C	Glasgow
M'Laughlin, J.	1C	Belfast
Moffatt, Alfonso	1C	N Shields
Morrison, J J	2C	Liverpool
Muir, Walter L.	2C	Liverpool
Murray, R. Y	1C	Leith
Oldfield, Albert	2C	Glasgow
Pringle, F H M	2C	Glasgow
Reid, Robert . .	2C	Glasgow
Reid, John W	1C	Leith
Richardson, T R	2C	Glasgow
Robinson, C F	2C	Glasgow
Sale, Bertram V	1C	Liverpool
Sargent, F J	2C	South'ton
Shanks, James	1C	Glasgow
Smith, Robert	2C	N Shields
Thomson, D.W	2C	N Shields
Tidman, W E.	2C	South'ton
Webb, Arth L	2C	Liverpool
Weir, Archibald	1C	Glasgow
Wilcox, H S . .	1C	London
Williams, J K	2C	Glasgow

March 14th

Anderson, W D	1C	Dundee
Akester, S C . .	2C	Hull
Baird, W G . .	2C	London
Boyle, James . .	1C	Cork
Byers, J A.M'P	2C	N Shields
Currie, Theo	2C	Greenock
Ferguson, David	1C	Greenock
Gardner, Arch	2C	N Shields
Hadland, Victor	2C	Hull
Harris, Philip . .	2C	London
Hendry, J. B . .	2C	Hull
Hoge, Alf G. . .	2C	London
Kendrick, Arth.	1C	Hull
Kinghorn, Thos	1C	N Shields
Kyle, H R. T	2C	Liverpool
Lambert, Wm.	1C	N Shields
Mathie, F J B.	1C	London
M'Connell, D J	2C	Greenock
M'Creery, H G.	1C	N Shields
Millar, M. R . .	2C	Greenock
Mitchell, W R.	2C	Dundee
Moreton, T G	1C	N Shields
Morrice, D M B	2C	Greenock
Nickson, E N	2C	Liverpool
Pit, Edwin	1C	Hull
Potts, Lewis G.	2C	N Shields
Price, Stanley	1C	Liverpool
Pritchard, Wm	1C	Liverpool
Richardson, A H	2C	Liverpool
Robertson, Wm	1C	N Shields
Scott, W. V . .	1C	N Shields
Shennan, J B	2C	Liverpool
Taphouse, H W	2C	London
Taylor, Fred G	2C	Hull
Westwood, D	2C	Greenock
Williams, R J	2C	Liverpool

March 21st

Alexander, R Q	1C	Leith
Barry, John J	2C	Liverpool
Beattie, William	1C	Leith
Blyth, Robert	2C	Glasgow
Botterill, W C	2C	Cardiff
Bowker, Ernest	2C	South'ton
Bridson, Jas H.	2C	Liverpool
Broadbent, R J	1C	Liverpool
Buchan, G R	1C	Leith
Butler, John . .	1C	Leith
Caminondo, A	1C	Liverpool
Cleere, John A	2C	Liverpool
Collingwood, J	2C	Glasgow
Cox, Herbert H	2C	London
Dalby, G W	2C	Cardiff
Davies, Willie	1C	Cardiff
Deer, Harold . .	1C	South'ton
Edge, Wm E	1C	London
Evans, Benj E	2C	Liverpool
Farrage, Jas R	1C	N Shields
Farrow S L . .	1C	W Hart'l
Fayle, Thos J	1C	Liverpool
Fraser, Thomas	1C	Glasgow
Hamlet, H W	2C	Cardiff
Harrison, W B	1C	N Shields
Heads, Ernest	2C	N Shields
Hill, William K	1C	South'ton
Hutton, Geo M	2C	Glasgow
Jackson, W S	1C	Glasgow
Jardine, John . .	1C	Glasgow
Jeffrey, Stanley	1C	Glasgow
Kay, Wm H . .	1C	N Shields
Lowdon, J L	1C	Cardiff
Luke, Harry . .	2C	N Shields
McAlpine, S. . .	1C	Barrow
McGavin, D A	1C	Glasgow
M'Donald, W	2C	London
M'Dougall, J E	1C	London
Mitchell, D . .	2C	South'ton
Montgomery, S	1C	Glasgow
Morrison, H . .	2C	Glasgow
Newrick, C W	2C	W Hart'l
Penman, David	1C	Leith
Pollard, Henry	2C	Liverpool
Rathbone, W L	2C	Leith
Reader, S. J . .	1C	N Shields
Roberts, R B	2C	Cardiff
Robson, John . .	2C	N Shields
Ronchitti, J W	2C	W Hart'l
Runciman, T H.	2C	N.Shields
Smith, Wm S	2C	Cardiff
Soulsby, George	2C	Liverpool
Sutherland, W	2C	Glasgow
Ternan, Edward	2C	Glasgow
Todd, Lawrance	2C	W Hart'l
Tweedie, John	1C	Glasgow
Waite, John W	1C	Barrow
Walters, A S	1C	Glasgow
Weir, John	2C	Glasgow
Wood, Frank A	2C	Barrow
Williams, M. O	2C	Cardiff

March 28th

Arthur, John G	2C	Aberdeen
Bardsley, H	2C	Liverpool
Breach, Harold	2C	London
Buck, Arthur F	2C	London
Cameron, A . .	2C	Greenock
Cameron, D. . .	2C	Aberdeen
Campbell, Robt	2C	Greenock
Chapman, E P	1C	London
Christian, J. W.	1C	Liverpool
Clarke, Jas W	1C	Liverpool
Congdon, J A	2C	London
Cringle, John . .	2C	Greenock
Dalziel, William	2C	Greenock
Davis, Lewis C	1C	London
Doubtfire, Ed	1C	Hull
Drury, James A	1C	Hull
Fraser, Alex. . .	1C	Greenock
Frisken, A	2C	Aberdeen
Hodgson, C B	2C	Liverpool
Jacobs, Geo J	1C	London
Jobling, R R . .	2C	N Shields
Kemp, James L	1C	Greenock
Lowes, R T. . .	1C	N.Shields
Lowson, G L	2C	Aberdeen
Lugrin, F G . .	2C	N Shields
Mackie, W D	2C	London
Maltby, Jos A	2C	N Shields
M'Arthur, D . .	2C	Greenock
Melvin, John . .	2C	Aberdeen
Mitchell H G	2C	London
M'Master, W A	2C	Liverpool
Morrison, J S	1C	Aberdeen
Mumby, Ed R.	1C	Hull
Nicholson, A E	2C	Liverpool
Niddrie, Jas H	1C	N.Shields
Porter, John C	1C	Aberdeen
Ritchie, Alf C	2C	Aberdeen
Russell, Joseph	1C	Sunderl'd
Simpson Harry	1C	Sunderl'd
Small, William	2C	Aberdeen
Spathis, Paul . .	2C	N Shields
Stephenson, T H	2C	Liverpool
Sullivan, John	1C	London
Teare, John O	1C	Liverpool
Thompson J	2C	Greenock
Turner, W C	2C	London
Walton, R C	1C	London
Williams J G	2C	Liverpool
Wilson, Chas F	2C	N Shields

April 4th

Ackers, Joseph	1C	Liverpool
Bool, Ernest A	2C	Cardiff
Cameron, A A	1C	Glasgow
Campbell, A B	1C	Glasgow
Campbell, R . .	2C	South'ton
Clear, Philip T	1C	Falmouth
Cornet, Frank . .	2C	Glasgow
Cowley, Stanley	2C	Liverpool
Cross, Alex. M	1C	Glasgow
Dawkins, W A	2C	South'ton
Douglas, W H	2C	Liverpool
Dowman, A. H	1C	South'ton
Earnshaw, Wm	1C	London
Evans, Thos R	2C	Cardiff
Fearn, Stanley F	1C	Liverpool
Fogg, Arthur . .	1C	Cardiff
Gendall, Rich	1C	Falmouth
Glassford, John	2C	Liverpool
Glennie, J M'K	2C	Leith
Gordon, Neil	1C	Glasgow
Greenfield, H J	C	London
Hamilton, Jas	1C	Glasgow
Henderson, W	1C	Glasgow
Jenkins, C E	2C	South'ton
Johnston, Albert	2C	Glasgow
Jones, Thos R	2C	Cardiff
Landells J W	1C	N.Shields
Lapper, Wm J	1C	London
Macdonald, J	2C	London
Mackay, W. G	1C	Glasgow
Mason, David	2C	Leith
M'Kechnie, Geo	1C	Glasgow
M'Keddie, J G	1C	Leith
Nicholson, R . .	1C	N Shields
Rigmaiden, A E	1C	Liverpool
Scott, George . .	2C	N Shields
Smith, Geo W	2C	London
Sturrock, G S	2C	Leith
Swenson, E H	1C	N.Shields
Tait, Harold . .	2C	N Shields
Thomas, R G	2C	London
Thomas, W L	2C	Liverpool
Valentine E N	1C	Cardiff
Westhead, F . .	2C	Liverpool
Williams, C. H	2C	N Shields
Williams, Wm	2C	Glasgow
Yule, John	2C	N Shields

April 11th

Batty, Arthur . .	1C	Liverpool
Caine, Eric	2C	Liverpool
Cunningham, A	2C	Liverpool
Dale, L D S	1C	London
Davies, Henry J	1C	London
Dunbar, P J P.	1C	London
Forster, A I E	2C	N Shields
Greenslade, S	1C	London
Grimes, Thos A	1C	N Shields
Hornsby, W . .	2C	N Shields
Jamieson, Thos	2C	Liverpool
Johnson, J W	2C	N Shields
Jordon F S . .	1C	London
Lane Joseph . .	1C	N.Shields
Leaf, John N . .	1C	N Shields
M'Burney, J T	2C	London
Mitchell, N F S	2C	London
M'Stea, Wm J	2C	N Shields
Murray, John . .	2C	Liverpool
Pratt, Samuel . .	1C	Liverpool
Randall, F G	1C	London
Shiner, W C .	1C	London
Spithray, J W E	1C	Liverpool
Storey, John . .	1C	N Shields

The Marine Engineer

And Naval Architect.

LONDON, JUNE 1, 1908.

LABOUR DISPUTES AND NATIONAL DEFENCE.

THE fact that the labour dispute in the shipbuilding trade has been satisfactorily settled will relieve much uneasiness in regard to its aspects in connection with naval construction. Although there was no immediate cause for alarm, there can be no doubt that if the dispute had been protracted it would have had a material effect, and that of an adverse character, not only upon the completion of work in the private yards, but also that in the public establishments. The dispute was not confined to one body of men, and it affected a much larger number than those actually engaged in the industrial warfare. There were three distinct and separate quarrels. First, that of the associated shipwrights, joiners, cabinet makers and other wood workers, which had been going on since the beginning of the year, and which, beginning on the north-east coast, had resulted in a lock-out from the federated shipyards. Secondly, there are the engineers of the north-east coast, who have been on strike since the beginning of the year, with the result that much of the auxiliary machinery for ships in hand is behind. And then there is the trouble at the graving docks, which has been going on for about the same length of time, but which does not so directly interfere with naval work. It may be said indeed that until the lock-out occurred it was the engineers' strike which seemed likely to be productive of the most harm. In all such matters as guns, gun-mountings, propelling machinery and a number of other important matters the contractors are now much behindhand, and many of the ships which should have been completed have been delayed in consequence. It is, of course, impossible to say to what extent the national interests have already been affected, but that they have suffered is beyond a doubt.

To understand how the national interests may suffer from delays in construction and supply of ships, and other matters pertaining to their equipment and armament, it is only necessary to look back to the results of the dispute in the engineering trade in 1897-8, when the contractors were unable to keep their time, and large sums of money which had been voted by Parliament remained unspent. In his Memorandum, explanatory of the Navy Estimates for 1898-9, the late Lord Goschen, who was then First Lord of the Admiralty, stated that expenditure on new construction had been most seriously affected by the prolonged labour difficulties, which had lasted from July to the beginning of February. He said that the payments to contractors had been so disarranged by the suspension of work that it was almost impossible to put down the exact amount by which the anticipated expenditure on new construction would fall short. He believed that it would be a fair estimate to place it at nearly two and a half millions, and, as a matter of fact, it came to even more than this sum. Among the matters about which difficulties occurred he mentioned propelling and auxiliary machinery, gun-mountings, armour and many other important classes of materials, and he pointed out, too, that the indirect effects of these labour difficulties were not at all confined to contract ships. In the public yards the delays on the part of the contractors in the completion and delivery of machinery, armour and so on involved considerable difficulty in carrying on the work of construction in the manner essential to the earliest possible completion of the ships. In other directions delays occurred in the steam and gunnery trials of ships which should have been completed and ready for service. Of course, on the contract side the retardation of work was even greater; not only in the form of arrested progress on all descriptions of material directly affected by the absence of the workers, but also in connection with the hulls and fittings of ships laid down. The First Lord estimated that the actual dates of completion for the service of the ships in hand were deferred by an interval practically equal to the time over which the dispute extended. It is scarcely necessary to point out that a delay of six months, which is practically certain, or it may be, of a longer period, will have a most disastrous effect upon a programme, the extent of which was at least in part calculated on a basis of time, the main argument in support of a lesser number of ships than was originally proposed being our assumed ability to build and complete at a quicker rate than our rivals.

If we had had a repetition this year of the state of affairs that troubled Lord Goschen, the result might have been most dangerous. We have in any case only a very small margin to work upon, and Germany is showing increased activity in every direction. She has been accelerating her rate of output for some years, and in every way hastening the construction of her new and formidable ships. Nor is it easy to say how the authorities can provide a remedy. Trouble has already arisen at Devonport, where dockyard fitters were employed to assist in the completion of a contract. This action at once caused a movement on the part of the trade unionists, and under pressure the Admiralty were forced to withdraw the men. It was pointed out that a resort to such methods would be inimical to the interests of trade unionists, whether they were on strike for the contractors or working in the dockyards, because in the latter case they would incur penalties from their unions which might cause them to lose whatever they might have been entitled to in other circumstances. Evidently, the Government dare not move in the matter and are practically

at the mercy of the unions, while the contractors themselves are fully secured by the strike clauses. Nor does it seem possible to advance the work by giving orders ahead, although something like this or in this direction appears to have been attempted by Lord Goschen's Board. In the meantime, not only is work in hand pressing, but more ships are wanted, and a very large programme will either have to be entered upon in the autumn or early next year. That, as the result of the national ballot of the trade societies, the paralysis of the shipbuilding trade no longer exists, must be most satisfactory to all interested in the maintenance of our supremacy at sea. Independent of this aspect, too, it is satisfactory to know that the resumption of work will put an end to the misery and suffering which the struggle has entailed upon thousands who were not directly implicated in the dispute.

AN ANALYSIS OF THE RESISTANCE OF SHIPS

On this subject of an analysis of the wave resistance to the hulls of vessels Professor Wm. Hovgaard has contributed a detailed paper to the Institution of Naval Architects, in which he gives a rough approximation to the resistance apart from wave interference, and only for ships of ordinary form. A knowledge of such a formula, especially if it can be made to include the effects of wave interference, cannot fail to be of great practical importance. Not until tanks are established for research work, such as the one recently proposed by Sir William White, will questions like the present one and many others equally important find their solution. Following a sketch showing the formation of ship waves, Professor Hovgaard considers the speed term, and the term involving the principal dimensions, with the term involving the fineness, so as finally to give a formula which states the resistance in terms dependent on the co-efficient of friction as given in Froude's table, multiplied into the wetted surface in square feet, and into the knots per hour, at a power less than the square, with a considerable addition involving the product of the mean draught in feet into the extreme breadth on water line in feet, squared, divided by the length of ship on water line in feet, squared, multiplied by the velocity in knots per hour to the fourth power.

A NEW METHOD OF INVESTIGATING SHIP PROPULSION.

Herr Wellenkamp has produced a method of investigating the fluid resistance and propulsion of ships and has kindly read a paper on the same before the Institution of Naval Architects, in which he describes a new model of a hull with a tank, which need not be longer than $4\frac{1}{2}$ times the length of the longest model that is to be tested. This tank and apparatus in comparison with a tank at least 50 metres in length, if not much longer, brings the present apparatus within the means of small people, and particularly where the carriage with rails and mechanical tractive power are not used. This apparatus is described by Herr Wellenkamp to be a thin piano wire attached to the long bowsprit of the model, which is stretched horizontally above the water to the end of the tank, where it passes over a drum into a deep well, where the falling towing weight is attached thereto. To avoid the difficulty of the first acceleration of getting up speed, another weight added to another wire is attached to the model so that a necessary speed may be got up in a distance of one-and-a-half times the length of the model, at which time the speed is constant, the accelerating weight being then removed, when the tests required may be carried out. If experiments are required as to model propeller, these may be fitted to the model, and the speed of the propeller may be produced by a weight allowed to fall from the top of a mast, the said weight being attached to a bent wire carried upwards from the propeller to the head of the mast, and then passed over a pulley so as to allow the weight to pull down. It is well, with these experiments as to a propeller, to cause the model to be in static equilibrium, which is done by a wire being attached to the rear of the model and carrying a hanging weight equal to the front towing weight, to counterbalance each other, producing in the model a condition of static equilibrium, which will receive on the model the slightest propelling effect of any propeller caused to rotate upon the model.

TWO NOTES ON SHIP CALCULATIONS

Mr. W. S. Abell, R.C.N.C., has given, in his paper read before the Institution of Naval Architects, some useful details for those who have to work out areas in ship calculations, and also those who have to determine the position of the transverse metacentre relative to a ship. There are at least two notes by which the work to be done is much reduced, within the usual limit for error, in such calculations. The labour for stability calculation is obviously considerably shortened, while, in addition, the further time required to trace the body and to plot the cross curves need only require a further half-hour. He states that Gauss transverse sections amounting to five only will give as good result as nine Tchebyscheff sections. These Gauss transverse sections should be taken with five Simpson water planes. The whole of this paper may be taken as giving the necessary calculations to determine the water areas and also the position of the transverse metacentre with far less trouble and calculation than is at present required for this purpose.

MESSRS. BROWN BROS. & CO., LTD.

WITH a view to inspecting the latest type of hydraulic pumping engine, illustrated in the accompanying plates, we recently had the pleasure of visiting the Rosebank Ironworks of Messrs. Brown Bros., Edinburgh, where several of the newest models of the firm's specialities were in course of construction. The works, which were founded about forty years ago, in normal times give employment to about five hundred hands and extend over an area of between four and five acres, two-thirds of which is occupied by workshops, the frontage portion consisting of the designing and commercial departments. Conveniently situated for rail transit, the manufacture of the world-known starting, steering and hydraulic engines is carried on under eminently favourable circumstances.

Where the character of the work is to a great extent of a standard type the pattern shop naturally does not occupy an unduly large area, for although new patterns are continually in demand to keep pace with improved and altered designs, racks and stores are more in evidence.

The iron foundry is large and well-equipped with machinery, particularly that necessary for accurate wheel moulding, of which such varied styles of gearing are used. This has of itself created a large supply to the outside market in this special branch of casting, which the plant and experience at command is well calculated to maintain. As such a large portion of the output requires special castings in bronze and brass, this section of the foundry is no less important in regard to the attention necessarily given to the mixtures required, as, for instance, in the telemotor standards where iron or steel would cause compass deviation, in the hydraulic engine valve faces and pump plungers, where exceptional hardness is required, a mixture almost equal to Perkins' metal is here used, and in the case of worm-gearing a very tough bronze is necessary to withstand the stress and wear.

Adjacent to these shops is the copper depositing plant, where the hydraulic rams, and also such polished steel work as may be subject to corrosion by being exposed to sea air or water, are coated with electro-deposited copper.

Adjoining this building is the smith shop, so that all the rough material is centralized and conveniently located for conveyance into the machine shop.

The machine and erecting shops are combined in the main building, with a gallery round three sides for small machines and assembling light gear and parts, and have power hoists from one floor to the other. The main floor is served by one 30-ton and one 40-ton electric travelling crane, and several small electric and hand travellers give good lifting facilities to the smaller machine and erecting sections.

The motive power is supplied by sixteen gas engines, with compressed air starting gear, so arranged in batteries that sections of machines can be independently driven from any set of engines, or all coupled together by means of clutches. As with other firms who have installed gas motors, innumerable difficulties have had to be overcome, but the plant as now arranged has proved equal to all claims upon it, and has justified its adoption.

With the necessary external finish required on most of the work undertaken a decided preference for milling machines is most noticeable, many of these being converted planers, with an increased rapidity of output where no fitting is required. Several latest type Jones and Lamson and of Herbert capstan lathes are in operation, and a heavy Richards boring and surfacing machine has recently been laid down for dealing with special work, while a large number of the machines in use have been from time to time adapted from other models or constructed in the works as necessity arose. With such a large number of parts being cut from the solid material, as shaft pinions and worms, the new steels have supplanted the older type as far as is consistent with accuracy.

By virtue of the standard type of work, much of the material and finished parts and accessories can be made up in stock sizes, and one of the notably recent additions is an extension of store room for maintaining adequate supplies so that urgent orders can be fully met.

As seen from the photographs, the pumping engine referred to is of the direct-acting, inverted type, with the pumps driven direct off the crossheads, there being three cylinders so arranged that they work compounded, the one H.P. exhausting into two L.P. cylinders.

The floor space occupied is about 8 feet square, and the height from sole plate to cylinder top is about 12 feet. The principal dimensions are as follows:

Three cylinders, 14" dia. × 18" stroke.
Three pump plungers, $3\frac{3}{4}$" dia. × 18" stroke.
One hydraulic accumulator, $15\frac{1}{2}$" dia. × 5'-1" stroke.
Steam boiler pressure, 190 lbs. per sq. in.
Working pressure, 175 lbs. ,, ,, ,,
Hydraulic pressure, 1000 lbs. ,, ,, ,,

The accumulator is placed at the back of the engine, steam being admitted to the upper side of its piston through the main stop valve on the left, Fig. 1, issuing thence through the valve to the right, placed rather lower than the main stop valve, over the spring-loaded governor valve into the H.P. cylinder casing.

The governor valve is kept shut, when there is no pressure in the hydraulic system, by the spring fitted below it. When this pressure rises to about 400 or 500 lbs. per sq. inch the valve is opened by a small bore pipe connection with the system which acts on a plunger and rod, passing up inside the spring coil, and thus, lifting the valve, allows steam to flow into the engine, the valve remaining open so long as the pressure is maintained above this limit. Should, however the pressure suddenly fall, due to a burst at any point in the pipe range or deck gear, the governor valve immediately closes and throttles the admission, thus preventing any possibility of disastrous racing. A small admission of steam is always maintained, though the valve be shut, by boring two or three small holes through the valve, this giving sufficient steam to keep the engine just moving at a rate of a few strokes per minute.

As the hydraulic ram is raised by the pumps, the piston of the accumulator also rises till it closes the port in the cylinder which allows egress of steam to the engine, thus cutting off the main supply till the working of the deck gear takes off a sufficient quantity to allow the piston to fall below this port, when steam again flows into the engine, thus automatically main-

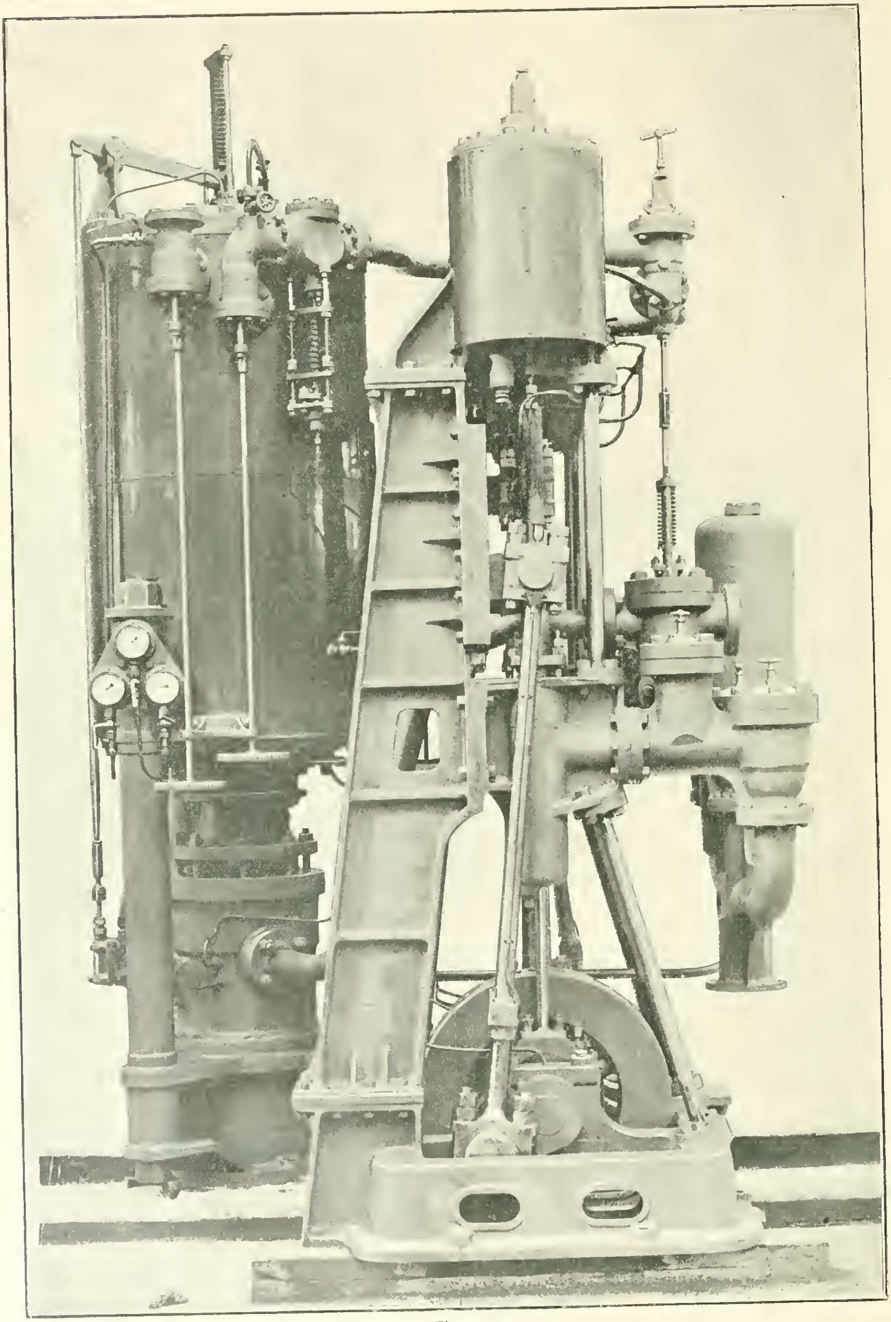


Fig. 1.

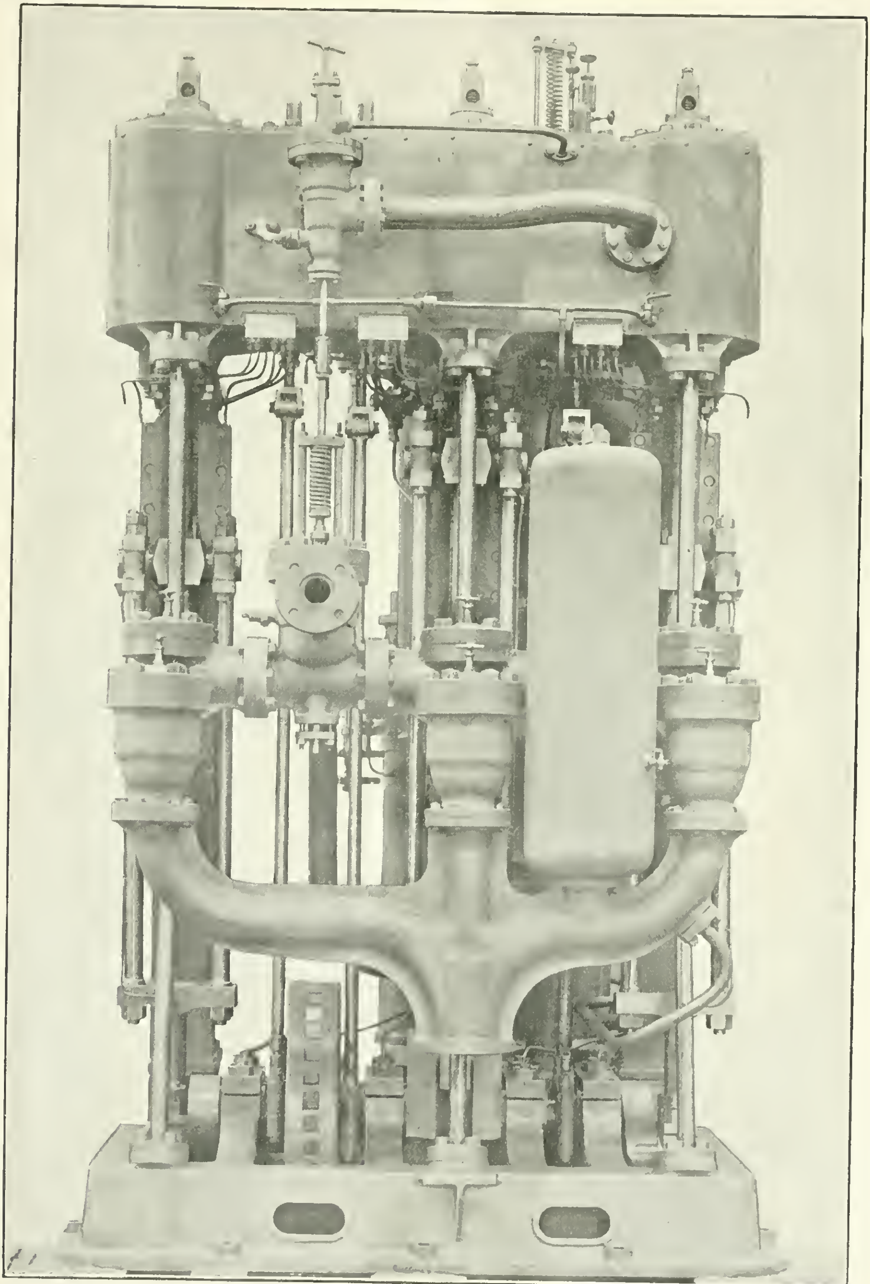


Fig. 2.

taining the pressure. Thus it will be seen the accumulator provides for small variations while working cargo constantly, the governor valve coming into action when the pressure is released by a fault or a heavy load being thrown on suddenly.

In order to prevent the engine stopping altogether, when the main steam supply is cut off from the accumulator, a small valve is fitted as seen on the throttle chest, with a connection to the top of the accumulator. By this means sufficient steam is always flowing to keep the engine moving at four or five strokes per minute, thus preventing excessive cylinder condensation with the possible risk of burst covers due to the collecting water.

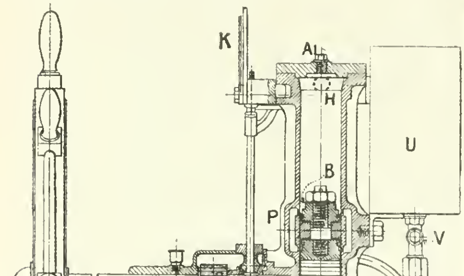


Fig 3 Brown's Patent Hydraulic Telemotor.

The spring, seen on top of the accumulator, is in compression, keeping the lever depressed under ordinary working conditions. Should, however, the ram rise so far that the main stop valve port is closed, thus cutting off steam altogether, the piston of the accumulator raises the lever by means of a stopper let through the cylinder cover, thus operating the small water valve on the extreme left, which releases the excess water, allowing the piston to be depressed below the steam admission port again. This should, of course, only come into action during extremely irregular working of the deck gear, when the slow motion of the engine might eventually, in a system where all the joints were tight, raise the ram, and obviously the loss of water thus ensuing is very slight.

The pump connection is seen on the right of the hydraulic cylinder leading from the delivery valve on the front of the engine.

Fig. 2 shows the arrangement of the suction and delivery valves. The water is drawn through the three suction valves to the pumps behind, thence passing the three delivery valves into the hydraulic discharge chest placed directly above the fly-wheel. One branch behind leads to the hydraulic cylinder, the other, in front, being the main lead to the deck, the pressure going to whichever requires it.

This hydraulic discharge valve is of spring-loaded, non-return type, kept open by the pressure from the pumps, and closed by the spring and the pressure of the accumulator when the engine stops or runs idle. The spring is connected through a rod to the compounding valve on the casing of the L.P. cylinders, the action of which is as follows. While the engine is running idle, just keeping itself moving, the valve barely opens and all three cylinders get live steam, the supply to the L.P. engines passes through the H.P. casing to the small pipe leading to the upper part of the chest; the H.P. exhaust passes along the large branch pipe into the chest, below the valve, and thence by the small pipe on the left into the L.P. exhaust to condenser or atmosphere.

When full bore steam is given to the H.P. cylinder, the pressure of the pumps opens the hydraulic valve, the control rod pushes up the compounding valve, simultaneously cutting off the live steam supply to the L.P. cylinders, and also the small bore H.P. exhaust, by means of two piston valves fitted to the valve rod in the upper and lower parts of the chest respectively. The main H.P. exhaust now passes along the branch pipe, up through the open compounding valve, into the L.P. casing, the engine thus working compound at full power, immediately the pumps discharge.

The entire working of the engine is thus automatically controlled with the utmost regard for economy, and although not perhaps guaranteed fool-proof, is a considerable step in advance of its predecessors, combining as it does their standard features with its own improvements.

Not the least important section of the work undertaken by the firm is in connection with their patent steam tillers, with hydraulic telemotor control.

In the early days of steering apparatus it was recognised that something was needed to supersede the many clumsy contrivances that were in use. By placing the engine aft, where obviously it ought to be, some means of control had to be devised that would operate from the bridge. The plan of running a light line of shafting from the wheel to the engine, although suitable for small boats where the fore and aft distances were not great, was not so adaptable to the requirements of large passenger vessels, with their multiplication of bulkheads and accommodation, owing to the necessary evils of gearing and oiled bearings. Some means were required that would be independent of these drawbacks, and the idea of water transmission appealed to A. B. Brown, the inventor, which culminated in his so eminently successful "telemotor" gear. By this method several steering

stations could be provided for—a telemotor standard for each—and, the change from one to another being made instantly, formed a weighty consideration in warship installations.

Fig. 3 shows the latest type of the telemotor standard in section. The main casting is bored for about two-thirds length to form the working cylinder; in the former models the cylinder was made in three parts, the bye-pass P being formed at the joints. This has, however, been discarded in favour of the simpler construction, as there was a tendency for the cup leathers to be frayed by the joint, and also a possibility of a leaky joint occurring. The bye-pass, as seen, consists of an annular space round the cylinder, rather deeper than the piston; at the top and bottom of this passage a ring of $\frac{1}{16}''$ holes, pitched $\frac{1}{4}''$, is bored, so that, when mid-position is reached, the pressure is equalized on each side of the piston by the excess water flowing from one end of the cylinder to the other.

The piston B and internal rack C are combined in one brass casting, the rack portion being of semi-circular section, relieved at intervals, is turned to the cylinder diameter to form a guide against the pressure of the pinion D. This pinion is cut solid with the

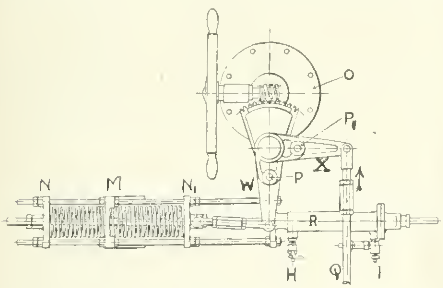


Fig 4

shaft E, which is rotated by the keyed-on spur wheel F gearing into the pinion G of the steering-wheel shaft L.

The tank U, separately pinned to the standard, is filled with the actuating medium, a mixture of one part glycerine to about two of water; the tank is connected, through V, to the cylinder by way of a small chest fitted to the standard. This chest has two spring-loaded, non-return valves, so arranged that, with increased temperature, the excess water flows into the tank from the system, flowing back again by the other valve, when the temperature falls by a simple gravitation action.

As the piston is raised for porting the helm, the pressure is communicated through H to the system, the opposite transmission being through I, these two pipes lead to the gear aft. The valve S is kept shut under ordinary working conditions, only being opened when it is specially desired to equalize the pressure in the system without bringing the indicator back to its zero position.

The pressure in the telemotor standard is communicated, for port and starboard positions, through H and I to the motor cylinder gear aft (Fig. 4). One end of this cylinder R supports two guide rods, between which is placed an initially compresssd helical spring, fixed at M and free to slide at N and N_1 towards M, being held by the yokes at the ends and nuts on the guide rods. The piston rod of R extends through the coil, and is fixed to the yokes at N and N_1.

Due to the pressure from the telemotor the spring is compressed by the movement of the piston, and when this pressure is released, by taking the strain off the wheel, the spring adjusts itself to its original position, equalizing the pressure in the system, and the telemotor wheel runs back to its zero position with the piston opposite the byepass. As the wheel is rotated the compression on the spring increases, and the amount of helm being given to the ship can thus be actually felt.

In the older type two springs were fitted side by side, but with a single one of larger diameter less power is required for the same effect, and no side-play is induced due to variations in the elasticity of the springs.

The two levers W and X are connected by a pin passing through P, the arm W is attached to the

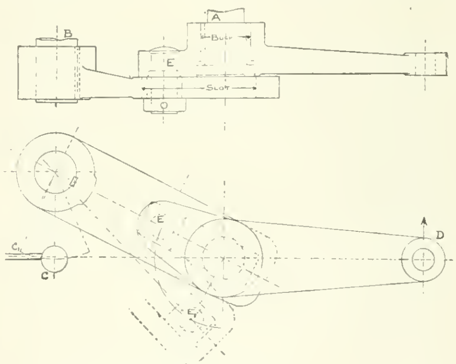


Fig. 5.

piston rod by a link, the arm X having a rod Q fitted to it.

The hand-wheel and worm gear is provided for controlling the steam to the steering engine should it be desired to disconnect the telemotor. This is effected by simply removing the pin from P and replacing it in P_1.

The pressure from the telemotor, through H, moves the piston along the cylinder R and operates the lever W, moving the rod Q in the direction of the arrow, thus giving steam to the engine by means of the control gear (Fig. 5), the rod Q being attached to the point D, as explained later.

Messrs. Brown's steam tiller is sufficiently well known to render anything more than an outline description superfluous. The motion is transmitted from a pair of engines placed horizontally side by side; a worm on the crank shaft rotates a large wheel on a vertical shaft, on the lower end of which is a pinion gearing into the massive rack quadrant, fixed by heavy standards to the deck and centred at the rudder post. The whole of the gear and engines are

mounted upon the tiller beam, pivoted at the rudder post to which it is fitted, and, as the engines rotate the gearing, the whole structure moves round the rack to the required rudder angle.

The tiller is extended beyond the rudder to carry a smaller rack operated by similar gearing for hand steering. The large rack is made in halves, jointed together at midships, so that as the middle portion becomes worn the two parts can be reversed, the worn ends going to the outside where the working is less frequent. Band brakes are fitted at each end of the tiller beam for holding the gear fast, operated by a hand wheel and worm gear. A slipper, fixed to the tiller beam, helps to carry the weight of the engines by sliding on the top of the rack, a steadying slipper being also fitted which bears on the under side of the rack just at midships.

The steam control makes use of this motion of the tiller to cut off when the necessary angle is reached, and Fig. 5 shows the ingenious device whereby this is effected.

The two pins A and B are fixed points on the tiller, so that the line of their centres is always at a fixed angle to the rudder, whatever its position. The pin A is fitted in a socket directly above the centre of the rudder post, B is keyed to the lever shown and also to a smaller lever at its upper end, the outer pin of which is connected from C by a link with the control valve spindle of the engine.

This gear is operated by a rod connected through D to the motor cylinder lever already referred to. As D is moved in the direction of the arrow the upper lever rotates round A, causing the pin E to move in a circular path towards E_1. This pin is riveted to the upper lever, and passes through a square brass block fitted into a slot cut in the lower lever. As E moves, the block is constrained to slide along the slot to a position E_1, thus moving the lower lever and rotating B. The small lever fitted to B thus moves the pin C to C_1, operating the control valve spindle and giving steam to the engine.

The motion of the engine now carries the tiller round the rack, and as B thus revolves round A the slotted lever is brought again into line with AB; the pin E, moving from E_1 to its original position, steam is automatically cut off and the engine is stopped, and the rudder remains at port or starboard till the telemoter moves D back to its original position, when the motion is repeated till the midship position or the new angle to which the telemotor is set is gained.

It is evident, from the path of E, that opening and closing to steam is quick and decided for the smaller angles, reaching a maximum when the slot is tangential to this path circle; thereafter the valve tends to close slightly, so that even with steam off the engine no damage can result by jamming the telemotor hard over, and when steering entirely by hand the telemotor need not be disconnected.

The steam valve is of the piston type, its own movement opening and closing the patent double-beat economic valve, which, at mid position, shuts off steam to the valve chest absolutely.

The design of the steam trunnions has been recently modified, as also the worm-wheel gear, the wheel being made larger and the worm double-threaded. The two oil pumps, driven direct off the eccentrics, are of the valveless type, discharging into a gravity-feed tank, and the piston rods have been lengthened to avoid carrying oil into the steam glands, the distance between the cylinders and the pan being increased.

The predilection for the water medium, which is so characteristic, well justifies the coupling of 'hydraulic' with the name of the firm, and their combined steam and hydraulic starting engines are no exception to this rule; even where the steam gear alone is fitted, a fluid buffer is employed in the cataract cylinder. Though the original form is still preserved, modern contrivances are here also not found wanting, the valve gear notably having undergone radical changes. The valve was formerly operated by a coarse thread nut rotating a long screwed spindle by being forced along it by the piston rod. To the lower end of this spindle was fitted a fine threaded spindle working in a nut, the revolving spindle raising or lowering the valve by its screwing action in this nut; this served the purpose, but it was perhaps slightly diverted ingenuity in regard to economical manufacture and working, considering the friction attendant upon rotating a spindle by forcing a nut upon it.

The present patent consists of two plain rod links, one attached to the starting lever, the other to the valve spindle, both being connected at their upper end to a lever to which is fixed a curved link, its concave side being towards the piston rod. This link slides in a bracket fitted to the piston rod. The starting lever, for the ahead position, depresses both rods, and as the piston rod falls, due to steam being admitted to the upper end of the cylinder, it gradually tilts the link and depresses the valve rod at the end of the lever, thus closing the steam admission.

Although Brown's specialities have been so long on the market that they have become embodied in the creed of the marine engineer, it is a tribute to the master mind which evolved them that the original forms should still be so evident beneath the improvements effected within recent years by up-to-date methods and perfected experience, which have kept these auxiliaries in line with, if not ahead of, modern practice, where absolute reliability is so vital as to barely give place to the all-important cost of production.

INSTITUTE OF MARINE ENGINEERS.—A course of three lectures on "Suction gas producers" will be delivered on Wednesday evenings, May 27th, June 3rd and June 10th at the East London College, Mile End Road, at 8 p.m., by Mr. C. A. Smith, B.Sc., to which members of the Institute are cordially invited, also all engineers interested in the subject.

THE POET BURNS AND THE FIRST STEAMBOAT.—Captain D. W. Bairnsfather, a great grandson of Patrick Miller, of Dalswinton, whose share in the experiments directly leading to the introduction of steam for navigation is well known, has presented to the trustees of Burns's Cottage at Ayr a photograph of the painting by Alexander Nasmyth at present in the Victoria and Albert Museum, Kensington, which represents the first steamboat being tried on the lake at Dalswinton, October 14th, 1788. The poet Burns at that time was a tenant of Mr. Miller's farm of Ellisland, and in the autobiography of Nasmyth he is represented as having been on board the vessel on the occasion. The truth of this has sometimes being questioned, and it at least seems strange that the observant and poetic genius who could immortalize a "field mouse" or a "mountain daisy" has made no allusion, in verse or letter, to the astonishing and memorable experience of assisting at the trial trip of the first boat to be propelled by the power of steam.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Combine

has suffered a couple of collisions since the last instalment of these notes went to press. First of all, there was the unfortunate and serious collision between the American liner *St. Paul*, outward bound from Southampton for New York, with H.M. protected cruiser *Gladiator* inside the Needles. Whilst the conduct of those in charge of the two ships is still *sub judice* it would be manifestly improper to say much on the subject. But it may be observed that the surprise expressed by the general press on the results of the collision seems in no real way justified. The *Gladiator* is a small vessel, judged by the standards of the North Atlantic passenger trade. At all events her displacement, when fully loaded, is between five and six thousand tons. Her sole protection in the way of armour is a curved steel deck—she has no side armour. The weight of the *St. Paul* is fully three times hers, when, as in the case under discussion, she is leaving port, coaled and provisioned for an Atlantic voyage. A weight of, say, seventeen thousand tons moving at some speed through the water would crash through almost any resistance—as witness the effect of the ram of H.M.S. *Camperdown*—a much smaller ship than the *St. Paul*—on the ill-fated *Victoria*—fully armoured though she was—in the Mediterranean Sea some fourteen years ago. The *St. Paul* is dry docked at Southampton, having a new stem fitted and certain plates renewed, after which she will be as efficient as ever. But the Liverpool Salvage Association who have undertaken the work of raising the *Gladiator* have a tough job before them. Not only is the wreck lying on its beam ends, but it lies in a strong tide-way, where, as described by one newspaper correspondent, the vessel shakes with the pressure of the tidal stream, and is only kept from being rolled further over by the resistance of her masts and other deck hamper.

The other collision to which I refer takes us to early days. It occurred in the St. Lawrence, the two ships concerned being the Dominion Liner *Ottawa*, bound outwards to Liverpool, and the Norwegian steamer *Trold*, inward bound to the St. Lawrence. The collision occurred off Fame Point, and both vessels were sufficiently damaged to necessitate their putting into harbour—the *Ottawa* returning to Quebec with considerable damage forward. Some of my readers may remember that the *Ottawa*, though undistinguished in the Dominion service, is really a famous ship indeed, being the thirty-three year old *Germanic* of the White Star Line and once the holder of the blue ribbon of the Atlantic. The accident is an unfortunate one for the Dominion line, occurring as it does at the opening of the passenger season, and also at a time when the new tonnage which they are providing for the development of their St. Lawrence trade is not yet in the water.

By the way, speaking of the St. Lawrence trade, it may be interesting to note that the Canadian Pacific Railway has just entered upon a new field of activity by the purchase of an hotel in Paradise Street, Liverpool. In itself hotel-owning is not altogether a new phase of activity for up-to-date shipowners. The Mount Nelson Hotel at Cape Town is associated with, if not actually owned by, the Union Castle Company, and Sir Alfred Jones has provided much hotel accommodation for those who take advantage of his numerous service to the Canary Islands and the West Indies. But the "Boston," lately acquired by the Canadian Pacific Railway, is not quite a hostelry of the same description as those which I have named. It is rather a boarding-house for the convenience of emigrants passing through Liverpool on their way to the West. Their new purchase will enable the managers of the steamship company to cater for the comfort of those who travel on their tickets, from the moment they set foot in Liverpool till they actually go aboard the outward-bound steamer, and will in many ways benefit both the management and the traveller.

The Turbine System

continues to make its way. An order for a couple of fast passenger steamers, to be fitted with turbines on Mr. Parsons' principle, has just been placed by the Peruvian National Steamship Company with the Birkenhead firm of Messrs. Cammell, Laird & Company. The vessels in question are to be of about 360 ft. in length, with a beam of 46 ft. Their speed will be 18 knots and they will have accommodation for 350 passengers. The service for which they are designed is that between the ports of Callao and Panama, and the Government of Peru has promised the company a subsidy of some thirty thousand pounds per annum in respect of their provision and working. The gross tonnage of the ships is to be about 3500 tons.

The Cunard Company

has suffered some little disarrangement of its extra summer Wednesday service by a slight and unavoidable mishap to the *Mauretania*. This vessel left Queenstown in her usual course on the morning of the 3rd May. The same night at 11.30 p.m., when proceeding at full speed, she lost two blades from her forward port propeller through striking some submerged wreckage. In spite of this partial disablement and the encountering of fog on two days of her voyage, she accomplished the trip in about five days seven hours, and maintained an average speed of 23 knots. She left New York on the homeward run on her due date, Wednesday, the 13th May. But it was held to be desirable to dock her and renew the damaged blades. Accordingly she is, on arrival, being docked in the Canada dry dock and the sailing of the 23rd May, for which she was appointed, has been transferred to the *Campania*. Thus the voyage on Wednesday, 20th May, which properly fell to the *Campania*, has been left blank. The *Mauretania's* repairs will not necessitate her detention beyond Wednesday, the 27th May, for which date she has now been fixed.

Messrs. Elder Dempster & Co.

have had on view in their Liverpool offices a model of one of the most famous ships ever constructed on the banks of the Mersey. The model of the historical *Alabama*—or No. 290, as she was known in the yard, and indeed until she commenced her career as a commerce destroyer—has been lent for exhibition by its owners, Messrs. Cammell, Laird & Co., the builders of the cruiser. Though she was found officially by the Geneva tribunal to have inflicted damage to the extent of some three and a quarter millions sterling on the ships and cargoes of North American shipowners during her brief career of activity, she was neither a large nor a formidable craft, being only 214 ft. long with a beam of 32 ft. Her gross tonnage was scarcely that of a modern river steamer, being but 682 tons gross register, whilst her speed under steam was 13 knots. Still in 1862—the year of her launch—13 knots was a high speed indeed for an ocean-going vessel, and in any case she will always be a memorable ship, even if modern developments make it unlikely that similar effects could be produced by similar vessels in future naval wars.

A singular coincidence

which seems to have escaped the notice of the general press may be noted in connection with the promotion of Mr. Winston Churchill to the position of President of the Board of Trade. When he was Under Secretary of the Colonies, a good deal of attention was attracted to his sayings and doings in regard to the question of Chinese labour in the South African mines. No sooner is he established in his new office than a Chinese question arises at the Board of Trade, and it is one which certainly affects most keenly those who go go down to the sea in ships. Ought it, or ought it not, to be allowed for Chinamen to be unrestrictedly employed as seamen and firemen? That their presence is a factor to be considered, needs no emphasizing. A short time ago their numbers were almost negligible. But on the 12th of May Mr. Havelock Wilson, M.P., stated in a public speech that there were 5000 of them now signing on in British ships in London, and that in six months' time that number would, according to the estimate of the Board of Trade, be doubled. There are, of course, Chinamen—as, for example, natives of Hong Kong—who are British subjects, and who are therefore entitled, like Lascars, to favourable consideration when they apply for employment under the Red Ensign. But one Chinaman is very like another, and it were easy for others besides Hong Kong natives to pass themselves off in the crowd.

It appears that on Saturday, the 9th May, when the steamship *Zambesi* was signing on her crew at Poplar, there was a considerable disturbance on the part of unemployed British

seamen who found that they were likely to be replaced by a Chinese crew, and similar scenes were repeated on the Monday following, when the steamship *Strathness* was engaging her crew. Many questions have been asked in the House of Commons on the subject, and the President of the Board of Trade has stated that the recent unusual increase in the number of Chinese seamen shipped in United Kingdom ports requires, and is receiving, prompt and searching attention, and must be regarded as a matter of serious concern.

Of serious concern indeed it must be, if the allegation of Mr. Havelock Wilson, to the effect that not one per cent. of these men have even a working knowledge of the English language, be true. This is a point which affects the management of the ships which carry them and means a great deal both to deck officers and engineers. There are further questions, too, in regard to the displacement of British-born sailors, and their consequent unemployment, and also in regard to the national position in view of the increase of foreigners in the mercantile marine, which, though highly important, are foreign to the scope of this column. But it may well be noted that England is not alone in the employment of Chinese. There are many to be found under the German mercantile flag.

The Fleetwood Service

of the Lancashire and Yorkshire and London and North-Western Railways has just been recruited by the addition to the fleet of the fine twin-screw liner *Duke of Albany*. Not only does the increase of traffic on the Fleetwood and Belfast route encourage the management to add improved vessels to the fleet, but it must be remembered that the steamers of the joint proprietors now work a North Sea service to Zeebrugge, and that thus probable expansion in that direction has also to be provided for. I hear a report that it is likely that two more twin-screw vessels for this fleet are to be ordered on the Clyde. The type of machinery—it will be noticed—is still reciprocating. Indeed, the London and North-Western management seem to have set themselves decidedly against any change in the direction of adopting the turbine principle in any of the fleets with which they are connected.

The Nord-Deutscher Lloyd Company

has, during the past month, sold three important vessels to local ship-breakers. All three were Fairfield-built craft and all fitted with triple-expansion engines driving single screws. The most important of the trio was the *Trave*, last of three sisters built for the express service of the Company about twenty years ago. It is a long time since this vessel was employed in the mail service, and indeed she has on several previous occasions been reported sold.

The Company and its affairs have of late been prominently before the German public, owing to the fact that a proposal was made that the Reichstag should increase their subsidy from the £279,500 per annum, which is now payable to it, to £304,500 for the establishment of additional mail services in the Far East. The extra £25,000 was to enable the Company to start a line between Australia and Japan, whilst there were to be other re-arrangements which would open up the line of German communications with New Guinea and Singapore. Some interesting figures were given in support of the measure, in order to show to the members and the electorate that money spent on steamship companies contributed to the expansion of German trade. It was said that in the last twenty years the value of German exports had risen from less than a million sterling to upwards of five millions per annum, whilst, though less striking than these figures, there were also immense increases in the exports to Australia and China. The Budget Committee, by one vote, passed the recommendation, but the House itself cut the amount of the proposed increase down to £11,500 a year, the company being at the same time released from its obligation to open up communications with New Guinea and Singapore. The reports of the debates are well worthy of attention, as they show a good deal of German methods for attracting trade, even to the extent of flattering British colonists by the despatch of German cruisers to their ports. The Germans evidently have practical faith in the truth of the maxim that " trade follows the flag."

The Burns Line, of Glasgow,

has now completed its purchase of the Dublin and Glasgow Steamship Company, and has registered a new undertaking under the style of the Burns Steamship Company (Limited), to carry on its business. The head office of the new venture is that of Messrs. G. & J. Burns, and the Board contains the names of gentlemen closely associated with the old Burns line.

The P. & O. Company

sent me the April issue of a publication which they are now issuing under the style of the P. & O. Handbook of Information. This is the first number, but it is to be continued quarterly. It gives much information of value to those who propose to travel by the vessels of their fleet, as it includes lists of services, agents, fares, regulations and the like. From the list of the fleet I see that the company now has, built and building, sixty-one ocean-going vessels, whose combined tonnage amounts to 413,955 tons, with 443,000 i.h.p. Adding twenty-nine tenders and craft the total tonnage of the fleet runs up to 417,263 tons. Further, I notice that of the sixty-one ocean steamers no less than thirty-three are of the twin-screw type. This shows how quickly the management turns over its fleet, for the company has only in quite recent years adopted the twin-screw principle, having for a long time held to the belief—now I think shown to have been unnecessarily alarmist—that there was risk of injury to propellers of twin-screw ships in the passage through the Suez Canal.

The Suez Canal,

by the way, has just issued a notice to the effect that vessels with draughts up to 28 ft. can now be permitted to navigate its waterway. In spite of the high return which this company makes to its shareholders, including amongst others the British Government, it cannot be denied that it has consistently adopted a policy of improvement and has always endeavoured to keep itself equal to the demands of modern steamship development. Twenty-eight feet not so long ago would have been a maximum draught for an Atlantic liner, and the depth of water in the canal does not now compare at all unfavourably with that available under certain circumstances in the river Thames tiself.

The White Star and Dominion Companies

have now issued an official statement as to their intended joint service to the St. Lawrence in the season of 1909. So far as is disclosed none of the present fleet of the White Star Company will be diverted to the service after all, the four vessels to be employed being the Dominion Company's twin-screw liners *Canada* and *Dominion* and the two vessels now building in Messrs. Harland & Wolff's yard and hitherto known as the *Alberta* and *Albany*. These vessels' names are to be changed to *Laurentic* and *Megantic* to signify not only their connection with the Canadian trade, but also to show that they are elements in the White Star fleet. The first of the two ships to be ready will be the *Laurentic*, which is to make a few trips in the New York trade during the winter of 1908-9 prior to the opening of the St. Lawrence service. Her performances will be watched with the greatest interest, as she is to be the first of the steamers to be fitted with the mixed installation of reciprocating and turbine engines, of which such great things are hoped in the way of coal economy. The centre propeller of her triple screws will be driven by a Parsons turbine engine, the steam passing through it having first been used in two sets of reciprocating engines for driving the wing screws. The initial pressure in the reciprocating engines will be 215 lbs. and the turbines will work it down to a pressure of 2 lbs. to the square inch.

The Mersey Docks and Harbour Board

is about to further increase the unrivalled facilities of the port of Liverpool by spending some three and a quarter millions of money in additional dock facilities. The new docks will accommodate vessels of 1100 ft. in length and will have a depth over the cills of no less than 40 ft. As in the last twenty years the maximum length of steamships has only grown from 560 to 760 ft., it would seem probable that it will be a good while before the 1100 ft. limit will be exceeded.

A word may be permitted on the name of the proposed new dock. It is to be called "Gladstone." The name is peculiarly appropriate. Though it will directly commemorate the able and respected chairman of the dock board it will indirectly recall his more distinguished relative, William Ewart Gladstone, one of Liverpool's most famous sons. It will cover the shore on which when a child residing with his family at Seaforth Hall, England's several times premier dug his first castles in the sand.

THE SCREW PROPELLER.

XVIII.

By A. E. SEATON, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

PROFESSOR COTTERILL has established the rule that thrust is independent of number of blades—that is, if the area of acting surface is the same with two propellers of the same diameter and pitch, the thrust will be the same, although one has two blades and the other four. Now this rule, like many others founded entirely on theory, requires to be taken with a certain amount of reservation. The four-bladed screw in practice will have narrower blades, so that the resistance to passage will be larger in proportion to their area than those of the two-bladed; and, further, the edge resistance of the four will be about double that of the two. Hence the effective power of the two-bladed will be higher than that of the four. By reference to the experimental trials of H.M.S. *Emerald* (page 354) it will be seen that the calculated thrust of the two-bladed common screw, having 87·8 square feet of surface, was 36,200 and the indicated thrust 48,800, as against 36,500 and 55,300 of the four-bladed common screw with 99·0 square feet of acting surface. On the other hand, of the screws tried on that ship the screw with six blades gave the highest efficiency, its surface being 103 square feet. But this was in some measure due to the lower number of revolutions made by the engines.

In practice it is usual to design screws having two blades with less surface than would be provided for three blades, and less for three blades than for four. Hence the following rule may be observed in deciding the acting surface of any screw:—

RULE.—Area of acting surface of a screw propeller

$$= K\sqrt{\frac{\text{I.H.P.}}{\text{Revolutions.}}}$$

Now there are several things which affect the value of K, and to determine it so that it shall apply to any and every ship requires some manipulation.

So long as all propeller blades are made of the prevailing shape, that is, approximating to the leaf in the case of express steamers and naval ships, and somewhat to the front half of a boot sole in the mercantile marine cargo carriers, it will be necessary to have a larger acting surface to the screw of a bluff tramp steamer, as well as a larger diameter. If we were content with the larger diameter and did not mind the shape, we might fit blades shaped like shovels such as more than one genius has registered at the Patent Office as his view of the most efficient screw.

When a screw is stuck on the end of a shaft which stands well away from the ship, as to allow free flow to and from the screws, as is generally the case with twin screws, such propellers will be more efficient than ordinary ones, and consequently both diameter and surface may be less than of single screws at the stern.

With a fine-lined ship where there is the least amount of obstruction to the feed or flow of water to the screw, and where the propeller will as a rule be well immersed and kept under water in a way that does not obtain with fuller lined ships, both single and twin screws will work more efficiently, and consequently may be of less diameter and surface.

The amount of total acting surface may be less with the broad blades of a two-bladed screw than with the narrower of the four-bladed variety, consequently a modification must be made in the value of K, which depends on the number of blades to each screw.

Let N be the number of blades of each propeller.

Let P be the prismatic co-efficient of the ship—that is, displacement multiplied by 35, divided by length, multiplied by midship immersed section.

In no case should this be taken as less than 0·55.

f is a factor which for single-screw ships is 11 and for twin screws 9. With triple screws the side ones, $f = 8$.

Then $K = f\sqrt{N} \times P$.

Take for an example (1): To find what amount of surface there should be on the propellers of a twin-screw ship whose I.H.P. is 30,000 when running at 70 revolutions, her prismatic co-efficient 0·6 and the number of blades on each screw is 4,

$K = 9 \times \sqrt{4} \times 0{\cdot}6 = 11{\cdot}4$.

Then surface $= 11{\cdot}4\sqrt{\frac{15000}{70}} = 166{\cdot}8$ square feet.

Example 2—How much surface ought a single-screw tramp steamer to have whose engines make 2000 I.H.P. when running at 56 revolutions, her prismatic co-efficient is 0·8 and her propeller has 4 blades?

Here $K = 11 \times \sqrt{4} \times 0{\cdot}8 = 17{\cdot}6$.

Surface $= 17{\cdot}6\sqrt{\frac{2000}{56}} = 105$ square feet.

Example 3—What surface should a triple-screw steamer have in her wing three bladed screws, her I.H.P. at each being 1,500 at 360 revolutions. The prismatic co-efficient is 0·55.

$K = 8 \times \sqrt{3} \times 0{\cdot}55 = 7{\cdot}612$.*

Surface $= 7{\cdot}612\sqrt{\frac{1500}{360}} = 15{\cdot}5$ square feet.

The middle screw $K = 11 \times \sqrt{3} \times 0{\cdot}55 = 10{\cdot}47$

Surface $= 10{\cdot}47\sqrt{\frac{1500}{360}} = 21{\cdot}4$ square feet.

The maximum breadth of blade is nowadays never at the tip as it was with the early screws, although it should be, if a complete column of water is to be projected by a screw, and the surface friction were very small. For aerial flight such screws may possibly be the best, but even when moving through air at high velocity there is big skin resistance, so that the broad tips would cause considerable resistance to revolution. The modern marine screw has much the same proportions that Griffiths recommended, but, of course, modified to suit the larger number of blades. The greatest breadth is often half-way out from the boss to the tip, and in other cases it is found at two-thirds of the radius or half diameter from the centre; Griffiths prescribed one seventh of the diameter as the breadth of tip for his two-bladed screws, and one-third for the maximum breadth. That is, the tip is to greatest width as 3 to 7. To-day this is not a bad proportion, especially when the blade end is square; otherwise four-sevenths may be taken with corners well rounded.

* For Articles I. to XVII., see previous issues.

The maximum breadth, however, may be arrived at for any screw by using the following :—

Rule for maximum breadth of blade

$$= M^3 \sqrt{\frac{\text{I.H.P.}}{\text{Revolutions.}}}$$

For a four-bladed screw, M = 14
For a three ,, ,, M = 17
For a two ,, ,, M = 22

The shape of propeller blades has undergone little change in the mercantile marine for some time, while in the navy and with express steamers the proportion rather than the shape has undergone variations due to the great increase in revolutions brought about chiefly by the general use of the vertical engine in H.M.S., and the confidence begotten from experience with the engines of which those supplied by Thornycroft and Yarrow for torpedo craft were the forerunners. The advent of the turbine some ten years ago as a marine motor laid it on engineers to go still higher in rate of revolution. To avoid excessive peripheral speed of screw the diameters have been reduced until now they are exceedingly small compared with old practice. The necessity for acting surface of blade, however, continued, and as there was no disposition to increase the number of blades, nor even to stick to the old fashioned four, there remained, therefore, as the only thing to be done to broaden them until they were changed from an elongated ellipse to a circle, and to-day blades may be seen which are greater in their broadest part than the length from root to tip. In fact, in the Navy to-day are to be seen blades which differ only from those of the old screw of the *Rattler*, whose length was one-fifth, by having the corners well-rounded. Surface ratio is therefore much greater, so much so that, whereas fifteen years ago for a three-bladed screw it was about 0·267, it is not uncommon to find it as high as 0·55. In the case of H.M.S. *Drake* the increase was from 0·268 to 0·371. In the mercantile marine the surface ratio has not varied nearly so much. Twenty-four years ago the ratio in large Atlantic liners having four blades was about 0·355. To-day the ratio is about 0·375, and that in consequence of the tendency to keep the diameter more in keeping with the necessities of the case than to the draught of water.

Materials used in the Construction of screw propellers were formerly limited to gun metal and cast iron. *Gun Metal* or *Bronze* was in the early days of screw propulsion looked on with great respect; it generally consisted of about 90 per cent. of copper, and 10 per cent. of tin, and not uncommonly had in addition a small modicum of lead, for, although the tensile strength was if anything reduced by the last metal, without it the bronze was difficult to turn and bore. It was easily melted, and good sound castings could be got at any time; its ultimate tensile strength was about 15 tons as against the 7 or 8 tons for the cast iron of the period. In 1845 there were very few iron ships, and in H.M. Navy ships were still almost entirely built of wood, with copper fastening. Moreover they were all sheathed with copper. Cast iron, except for guns, was never looked on with favour in H.M.S., and even if screws of it could have been used it is very doubtful if any naval officer would have cared to sail with one. It is true that in 1857 two or three four-bladed cast-iron screws were tried on a battle ship; they were, however, soon discarded, and never heard of again. In any case it is certain that with copper sheathing cast-iron screws would soon have corroded away. In the mercantile marine the iron ship had taken on, so that by 1850 the Inman Co. sent their first screw iron steamer across the Atlantic, s.s. *City of Glasgow*. The *Great Britain* was the first iron screw steamer to make the voyage from England to New York in 1845, having been altered from a paddle to a screw steamer by Brunel when being built at Bristol. In the mercantile marine wooden ships were often sheathed with zinc, and before they disappeared Muntz metal was largely used on account of its comparative cheapness for sheathing, and containing as it did 40 per cent. of zinc, it was not dangerous to the cast-iron screw, while zinc sheathing acted as a protector to it. Cast iron is still largely used for screws, and is likely to continue as the most convenient material for cargo steamers of all kinds, the speed of which does not exceed twelve knots, and for which refinements in make of blades hardly make themselves felt. The cast iron of to-day, which can be obtained in all parts of the world, is nearly as good as that formerly used in gun making; with common care in the selection of pig-iron and mixing and melting, a metal can be obtained whose ultimate tensile strength is ten tons, or even a little more, and whose yield point is higher than that of gun metal or common bronze. Cast iron, however, does not bend under a blow, and a succession of blows will break it, so that when a blade strikes a quay wall or some wreckage, the end generally breaks off, whereas the modern bronzes bend nearly double. Some engineers prefer that they should break rather than risk having a blade bent so as to foul in the stern frame. *Admiralty Bronze* to-day is made of 87 per cent. of copper, 8·0 of tin, and 5·0 of zinc, and has a tensile of about 14 tons in the casting.

In 1870 Messrs. Vickers & Sons, of Sheffield, introduced cast steel for screw blades, and for many years they did a good trade in them for Atlantic work. Blades of this material were much lighter than the cast-iron ones, and very much stronger and better calculated to stand the heavy work entailed by keeping at or near full speed in all weathers. This steel was made from crucibles, was hard and costly to machine, the blades had a rough surface and the pitch seldom uniform or true. Later on other firms took up the trade and used steel from the Siemens furnace, and abroad good castings were made from the Bessemer converter at much less cost than before, so that eventually the steel blades could be got at only about two to three times the cost of cast iron. But the severe corrosion which this material suffered in sea water has decided its fate more than anything else.

Manganese Bronze was a new alloy discovered and introduced by the late Mr. Percival M. Parsons, and consists of 81 per cent. of copper, 16·86 of manganese and 1·67 of iron. It has an ultimate strength of 67,000 lbs. with an extension of 21·5 per cent. in two inches. Screws of this material were first used in the Navy in 1879, and there after twenty-four years' work were found not to have corroded at all. The material is tough and bends very considerably before fracture. The Parsons Manganese Bronze Co. makes blades of the material of any size required and of a thickness

less than that of steel and the weight much less. The surface is smooth and the form as designed, the pitch being carefully preserved.

Stone's Bronze is also a very remarkable material and eminently suitable for propeller blades, inasmuch as it possesses the strength of steel as well as the toughness, while, without producing corrosion in the hull of the ship, it does not suffer appreciably itself. It is what is known as a zinc bronze, consisting as it does of 56 per cent. of copper 40·6 of zinc, 1·05 of tin and 1·67 of iron. Messrs. J. Stone & Co. make blades of all sizes of this metal, carefully cast to the design and with a smooth surface.

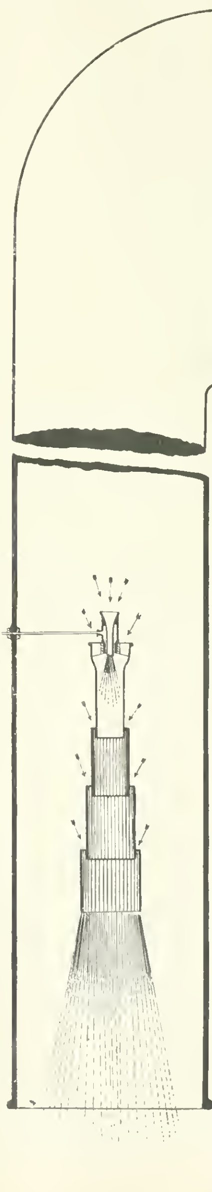
Delta Metal and *Bull's Metal* are also zinc bronzes having the strength and toughness of steel, and blades made of them have been quite satisfactory.

Propeller Bosses are not always made of the same material as the blades. A steel boss may be used with blades of cast iron, steel or bronze; with the latter there will be some corrosion unless carefully painted or zinc protected. For small screws cast-iron bosses are often fitted even when the blades are of bronze. But, seeing how much tougher a boss may be if cast of strong bronze and that the machining is less costly than steel, it would seem on the whole, especially in the case of express steamers, that the bosses should be of bronze too.

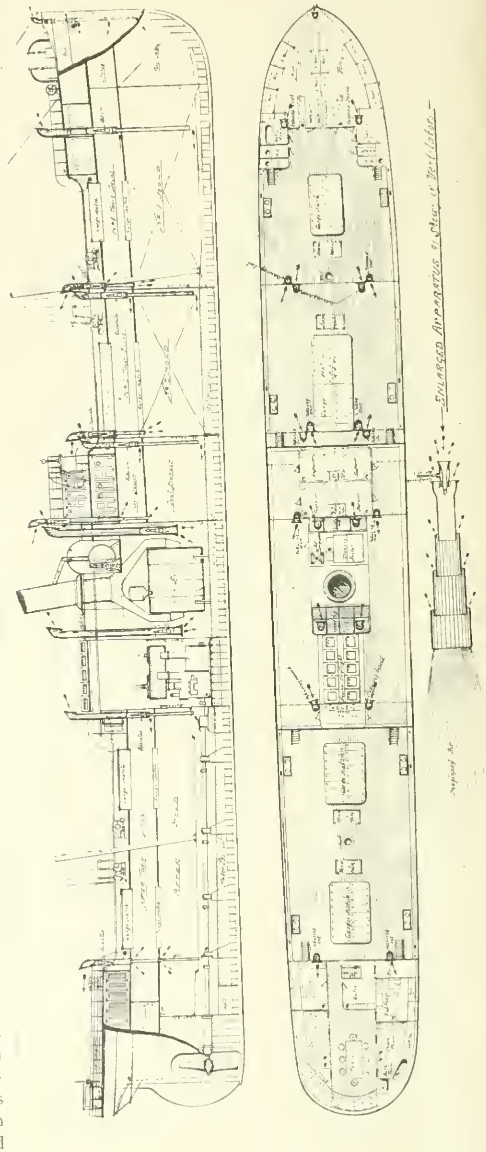
MEMORIAL OF LORD KELVIN. On May 5th a large and influential meeting was held in Glasgow to promote a memorial to signalize the exalted genius and profound scientific achievements of the late Lord Kelvin. Lord Provost Bilsland presided and amongst the speakers in support of the movement were Principal MacAlister, of Glasgow University, Sir Nathaniel Dunlop, Sir Samuel Chisholm, Sir James Bell, Professor Jack, Mr. Parker Smith and Mr. Hugh Reid. A resolution was passed to the effect that this "representative meeting of the citizens of Glasgow and the West of Scotland desires to mark in a fitting and permanent form its sense of the manifold benefits which Lord Kelvin's researches and discoveries in physical science and his patient application of the same to the common uses of man by sea and land have conferred upon the world, and accordingly hereby resolves to establish a worthy memorial of him in the city where he lived and laboured." While nothing definite was said as to the form which the memorial should take, Mr. Hugh Reid said that Glasgow would lose a glorious opportunity if it failed in the first place to let the memorial to Lord Kelvin be a statue in fit companionship with that to James Watt in George Square. Whatever else followed would doubtless be appropriate and could not be too great honour to their esteemed citizen. The meeting resolved to inaugurate a subscription memorial fund and open a Committee with full powers, the City Chamberlain to be honorary treasurer, and the Lord Provost convener. It was intimated at the close of the meeting that about £1,000 had been subscribed. In this connection it is worthy of notice that "Kelvin" has been put forward as a fitting term for use in the common language of science. The faculty and student officers of the United States Signal School Fort Leavensworth, Kansas, have endorsed the movement having for its end the adoption of the word "Kelvin" as the commercial unit of electrical energy at present expressed by the term "kilowatt" hour. This they do "believing that it is highly desirable to perpetuate the names and achievements of those who have been most prominent in the development of the science of electricity by bestowing their names upon the various units employed in that branch of science." This graceful tribute to his memory is one which would have touched the heart of the great *savant*.

VENTILATION.

VENTILATION is one of those subjects which, although frequently discussed and disposed of from time to time with some show of reason that improvements have been at least indicated,



yet return for consideration with fresh data and a pressing claim for more light. The ventilation of sewers and halls has received a great deal of attention, and has been consistently improved owing to the inspection rendered necessary by the civic authorities, backed by the Sanitary Institute, whose Congresses have been instrumental, not only in concentrating the attention of the members on different systems and possible improvements, but of giving information and warnings to the general public on the subject of hygiene. We have seen references made recently to ventilators being fitted in berthing accommodation on steamers where those for whose supposed benefit they were supplied nullified the intention by stopping up the ventilating shaft at the outlet to the quarters. Presumably this was done on account of a cold draught entering, possibly over a sleeping berth, as we have occasionally experienced. With a perfect arrangement of ventilation there should be no perceptible draught. The vitiated air should be expelled or, better still, induced to leave and give place to purer elements, while the fresh air should follow with as little disturbance as may be to the atmosphere of the confined space. Several systems of ventilation have been tried and improved upon as experience has dictated, and our attention has been called to another adaptation which promises well. The adaptation consists of a system of nozzles (as shown in the illustration) set in the ventilating shaft. The principle is similar to Green's, which was advocated, and to some extent adopted, about twenty-five years ago. The nozzles in the system illustrated are placed in the ventilators in the best positions to give good maximum results without causing abnormal velocity to create the unpleasant sensation prolific of influenza troubles a bad draught. The apparatus consists of a series of corrugated tubes of different sizes telescoped into one another slightly, and so arranged that at each diminishing diameter an annular space remains between the tubes of a certain area, sufficient for the vitiated air to flow in at the different junctions, and thus carry off at each position the noxious air or gases—an obvious advantage over the usual upcast ventilator, whether used for engine-room, stokehold or cabins, cargo-holds or bunkers. In ships where the cargo carried one part of a voyage gives off fumes detrimental to that to be carried on the succeeding run this system can be applied with success, and tanks cleared of gases efficiently and quickly. The nozzle is fitted into the smallest tube, and connected to a reservoir of compressed air by a pipe and valve which can be regulated to suit circumstances. The apparatus can be fitted into the ordinary ventilator as shown, used either as a downcast for fresh air or an upcast for foul air, while it can also be applied effectively for all spaces which it is desirable to free from a noxious or vitiated atmosphere. Instead of using compressed air from a reservoir, a centrifugal fan driven by a motor can be fitted for the purpose of supplying air to the nozzles, the discharge from the fan being arranged to take one or more compartments to suit the general arrangement of the steamer.



NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

ALMOST immediately after I sent my letter last month the lamentable disaster to the cruiser *Gladiator* occurred. I mentioned that several vessels of the Home Fleet had left the port for exercises, and it was while these were being carried out that the destroyer *Tiger* was lost. The *Gladiator* was returning from Portland on April 25th and during a blinding snowstorm she and the American *St. Paul* collided off Yarmouth, Isle of Wight, the death roll of the cruiser being twenty-seven. The ship is now lying on her side in shallow water less than a quarter of a mile from shore, and salvage operations are being carried out by the Liverpool Salvage Company, who state that it is one of the biggest jobs they have ever yet undertaken. It is confidently believed that the *Gladiator* can be rendered an effective unit again without any great outlay. She is a second-class protected cruiser of 5750 tons, and was built at this yard in 1896 at a cost of £287,604, so it is worth while spending a few thousands in trying to save her. During the twenty-four hours succeeding the disaster the staff of the signal stations in the yard was kept very busy, and the efficient manner in which all did their work evoked a memorandum of appreciation from Admiral Sir Arthur Fanshawe, the Commander-in-Chief. On May 7th Dr. Macnamara, the new Secretary to the Admiralty, came here with the Director of Dockyards and, accompanied by Mr. Apsey the manager of the Constructive Department, they visited the wreck of the *Gladiator*. During the same snowstorm the special service vessel *Magnet* was instrumental in saving the lives of eight men from a boat at Spithead. They had lost their bearings and were rapidly being driven out to sea. Gunner Cowle was in command of the *Magnet*, and he has since received a letter from Admiral Fanshawe expressing his appreciation of the promptness with which the vessel proceeded to the assistance of the men. A few days later—on April 28th—the battleship *Britannia* arrived and reported that an accident had occurred in her engine-room, by which five men had been injured. The men were landed and conveyed to Haslar Hospital, where three of them subsequently died. The battleship *Exmouth*, flagship of Vice-Admiral Sir Assheton Curzon-Howe, the Commander-in-Chief of the Atlantic Fleet, is undergoing a refit, which is to include arrangements for cooling her magazines. Another vessel to be refitted is the cruiser *Terrible*, which was paid off on May 4th. The new cruiser *Indomitable*, on her arrival here, created a good deal of interest, but no one was allowed on board unless with a special permit. Even naval officers, except those on duty, were kept off the ship. After carrying out her gun trials the vessel left on April 25th on her return to the Clyde. The refit of the battleship *Canopus* has been completed and she has been commissioned for service in the Mediterranean, for which station she will shortly leave. After over thirty-four years' service the Royal yacht *Osborne* has finally hauled down the pennant, and Captain Mansell, who had been in command of her since the beginning of last year, took over the command of the new yacht *Alexandra* on May 6th. Launched at Pembroke in 1870, the *Osborne* was first commissioned in 1874. She is built of wood and is now to be sold out of the service to be broken up ; the principal fittings of the Royal apartments however, have been removed to the new yacht. On May 11th the *Hecla*, parent ship for the Home Fleet destroyers, and about twenty destroyers and torpedo boats left for Campbeltown to carry out battle practice. Several of the vessels were under repair when the order was received for them to proceed to sea, but they were all got ready in time. The moorings for the destroyer flotilla are being laid down in Southampton Water with all possible expedition. The old *Devastation*, which in her time was as remarkable a vessel as the *Dreadnought*, has been sold out of the service. She was a low freeboard battleship of 9330 tons and had engines of 5510 horse power. The *Thunderer* was a similar type of vessel. Another old relic to go is the *Orontes*, which has been towed to the Motherbank. Some years ago she was renamed the *Swiftsure* and she has since done duty as a workshop for artisan ratings. The majority of the special service vessels of the local division of the Home Fleet will by June 4th have taken up their positions in Stokes Bay. This will enable the work on the new lock to be proceeded with.

Sheerness Dockyard.

We, in common with our friends at Portsmouth, have to mourn the loss of a destroyer, though luckily not with such a great loss of life as in the case of the *Tiger*. Strangely enough, our mishap was very similar. During an attack by the Eastern Destroyer Flotilla on the night of April 27th the scout *Attentive* struck the *Gala* in the after part of the engine-room. The fore part of the destroyer sank almost immediately, but the after part remained afloat for a little time. Engineer-Lieutenant Frank A. Fletcher, who was in his bunk at the time, was drowned, but the remainder of the officers and crew were fortunately saved. The *Attentive* afterwards came into collision with the destroyer *Ribble*, damaging her so severely that she had to be brought here for repairs. As Mr. McKenna stated in the House of Commons, these exercises are carried out hundreds of times, and the number of accidents that occur are remarkably few. Yet, judging from what many journals who know little or nothing of naval matters say, one would imagine that such accidents were of daily or even hourly occurrence. Wireless telegraphy placed us in possession of information of the collision almost as soon as it took place, and Rear-Admiral Casement, the superintendent, at once had all preparations made. The *Ribble* arrived under her own steam, convoyed by the *Attentive*. Although having water in her compartments, the destroyer was in no immediate danger. The *Charger* was on the blocks, but directly the yard opened she was got ready for floating, and within six hours of the damaged vessel entering the Medway she was shored up in dock and the water pumped out of her. The destroyer *Welland* is due for a refit, as is also the *Garry*, which is to have wireless telegraphy fitted. The destroyer *Wizard* has been surveyed and found to be worth the expense of a thorough overhaul. We are at present fully employed, there being in hand, in addition to the *Ribble*, the destroyers *Sprightly* and *Charger* and the gunboats *Speedy* and *Speedwell*. The battleship *Bulwark*, of the Home Fleet, was to have joined the Channel Fleet at the end of March, but she will not probably go until July, this being in consequence of the delay in the delivery of the new battleship *Lord Nelson* owing to the labour troubles on the Tyne. The report that the new armoured cruiser *Indomitable* is to join the Channel Fleet is received here with incredulity, for it has been generally understood that both she and her sister vessels, the *Inflexible* and *Invincible*, are to serve their first commission in the Home Fleet. The submarine depot ship *Thames*, the gunboat *Jason*, the special service vessel *Elfin*, and four submarines left on April 30th for a cruise to the Tyne. The same day the head-quarters of the flotilla were transferred to Harwich, to which port the flotilla has now returned. One of the submarines, "C5," was brought in on May 19th to be dry docked, having damaged her rudder by being carried by the tide against Haven Bridge, Yarmouth. The old battleship *Rodney* is to be berthed at Harwich for the submarines to take up their moorings alongside of her. Several obsolete vessels were sold here by auction on May 12th and fetched fairly good prices. The thirty-five-year-old battleship *Devastation* was sold for £21,700 ; the wooden line-of-battle-ships *Cambridge* and *Calcutta* went for £6800 and £5575 respectively ; the gunboat *Comet* went to a Dutch firm for £900, and the hulk *Briton*, which was built at Deptford in 1814, and was last employed as a Royal Naval Reserve drill ship at Inverness, was sold for £1800. With the exception of the first-named which is to be broken up in the United Kingdom within two years, all the vessels were sold without restrictions. The cruiser *Pactolus* was originally included in the sale list, but she was withdrawn. She was completed for sea in 1896, and could still do some service if needed. Five vessels of the class to which she belongs are now serving on the Australian station, one at the Cape and two in the East Indies Squadron. A commencement was made on April 24th in dredging Sheerness Bar in connection with the new channel. In the present channel there is only twenty feet of water on the bar at low water spring tides, but the new channel is to have a depth of twenty five feet.

Devonport Dockyard.

All five of the barbettes of the battleship *Téméraire* are now complete with mountings, shields and fittings, and more than half of her turbine machinery has been placed in position. The first of her ten 12-inch guns was placed on board on May 19th. Splendid progress has been made since the vessel was launched nine months ago, and there is very reason to believe that she will be ready for the pennant early next year. The construction of the battleship *Collingwood* is not proceeding so rapidly as did that of the *Téméraire*, but it is nevertheless being pushed on fairly quickly. It was at first expected that she would be ready to leave the slip in September, but it is more than likely that it will be somewhat near the end of the following month before she takes the water. The cruiser *Minotaur* left us on May 1st to join the Fifth Cruiser Squadron at the Nore. She was fitted with net defence which extends over the whole of the vitals, about 400 feet of the vessel's length being protected. The net, which it is claimed is impenetrable by torpedoes, is stored as usual when not in use on a shelf in line with the upper deck, and the arrangements for getting it into position and restowing are an improvement on the old plan and should ensure its being done in the shortest possible time. A wireless telegraph set of the latest low-power type has been supplied to the ship, and this will be used until the new high-power set is available. The new battleship *Agamemnon* will be taken over from the contractors on June 1st if her acceptance trials are satisfactory. Since arriving here from the Clyde the vessel has had cooling machinery fitted in the magazines. She is to join the Home Fleet at the Nore. The battleship *Hibernia*, having had a thorough refit, proceeded on May 1st to Portland to resume her duties as flagship of Vice-Admiral Sir Reginald Custance, the second in command of the Channel Fleet. While she was here a set of high-power generators for use with the new type of wireless apparatus was installed on board. The battleship *Russell*, of the Atlantic Fleet, which arrived here from Gibraltar about the middle of April, was moved into No. 3 Dock on May 14th for an examination of her underwater fittings and to enable the sighting appliances of the main armament to be retested. The refit of the net defence is nearly finished. The searchlight equipment of the battleship *Mars* has been strengthened by two 24-inch projectors, this raising her equipment to eight projectors. Control equipment for the combined working of the light quick-firing guns has also been supplied to the vessel. The cruiser *Andromeda* has completed an extensive refit, as has also the cruiser *Theseus*, tender to the Gunnery School. Improvements have been made in the submerged torpedo tubes of the latter vessel, the sluice valves having given some trouble in consequence of leakage. Her machinery defects were very slight. The *Aquarius*, depot ship for destroyers in the Channel Fleet was docked on May 5th for an examination to be made of the plates which sustained damage by the ship going aground at Oban through dragging her anchors. Some of the plates were found to be pierced, but these being near the ballast tanks which form practically a double bottom, no water found its way into the ship. The cruiser *Fox*, which was commissioned at Haulbowline on May 19th, has come on here for temporary service in the Home Fleet. She is to leave for the East Indies about the end of July to relieve the *Highflyer*, that vessel having sustained a fracture in the main crank shaft of her starboard engine, which has been temporarily repaired at Bombay. The reconstruction of torpedo boat No. 99 is proceeding and she is to be ready for recommissioning by September 30th. Much interest attaches to the work, as it is the first time that such work has been done on a torpedo boat in a Government yard. The gunboats *Circe* and *Hebe*, the parent ship *Forth* and several submarines left on April 30th for a cruise in the Channel between here and Falmouth. The *Circe* subsequently returned, having in tow "B8," which developed a weakness in her shaft bearings. The submarine was placed in dock to have her defects attended to and "B10" was sent to take her place. Submarines "A7," "A8," "A9" and "B2," in No. 5 Dock at the North Yard, are undergoing an overhaul of their external fittings, special attention being given to their rudders and propellers. It is expected that they will be ready to rejoin the flotilla by the end of May. A commencement has been made of the work of re-arming the "River" class of destroyers with three 12-pounders instead of five 6-pounders. The vessels will then have four of the former guns; they are also to be fitted with a special set of wireless instruments. The *Moy* was the first destroyer to be taken in hand. The annual entry examination for apprentices in the yard and for naval shipwrights commenced at the Devonport Technical Schools and the Athenæum on May 12th. There were three hundred candidates for sixty-five vacancies in the yard, and for the six openings for shipwrights, whereas last year the number of candidates was over four hundred.

Chatham Dockyard.

The policy of the Admiralty with regard to Chatham has again been subject to criticism, this time by Mr. Forde Ridley, the Conservative candidate, who paid a visit to the yard. Subsequently referring at a public meeting to what he had seen, he said it appeared that Chatham had a dock which ought to accommodate a *Dreadnought*, but owing to the cill of the dock being a foot or so too high and the water a foot or two too shallow that was not possible. He also added that a Government which allowed a state of things like that, when they were talking of spending millions of pounds on Rosyth, and when for the outlay of a few thousand pounds things could be improved at a dockyard on the East Coast, as Chatham was, such a Government were pursuing a policy which was both foolish and absurd. The accident to the cruiser *Gladiator* will upset our programme of work somewhat, as arrangements had been made for the vessel to undergo a thorough refit here, upwards of £20,000 being set apart for that purpose. The yard is not so full of work as it was a month or two ago, and the return of the *Implacable* from the Mediterranean is being looked forward to. Her refit will cost approximately £64,521, of which £52,100 will be expended on her hull, fittings and equipment, and £2135 on machinery by contractors. The vessel, which is to be relieved by the battleship *Ocean*, is to pay off at Devonpart on May 29th, and will shortly afterwards come on here. The *Ocean* is to be paid off at this port on June 1st, and the next day will be recommissioned by a crew sent round from Devonport, to which port the vessel belongs. The cruiser *Vindictive*, of the Nore Division of the Home Fleet, completed her refit on May 23rd. She has been selected for special service, and will shortly leave for the China station with new crews for the sloops *Clio* and *Cadmus*. The cruiser *Sutlej*, which had been in dockyard hands for several months past undergoing a thorough refit, was commissioned on May 12th to take the place of the *Hogue* in the Fourth Cruiser Squadron, to which squadron the *Sutlej* formerly belonged. Another vessel to leave us is the *Black Prince*, which, having completed her refit, left on May 1st to rejoin Rear-Admiral Sir Percy Scott's First Cruiser Squadron at Portland. The cruiser *Topaz* left on May 14th to resume duty with the Eastern Destroyer Flotilla at Harwich, the slight damage she sustained recently by colliding with a vessel in the Medway having been made good. Another vessel that will shortly leave is the cruiser *Latona*, which has for some time past been acting as tender to the *Pembroke*. She is to be commissioned on June 1st for service in the Home Fleet at Portsmouth.

Pembroke Dockyard.

The cruiser *Boadicea* was launched as arranged on May 14th, the naming ceremony being performed by Lady Kensington. There was a large and influential company assembled to see the vessel take the water, which she did without the slightest hitch. Mr. Pledge, the chief constructor, superintended the arrangements in the yard, and Staff-Captain Moulton was on board. It is unnecessary to enter into full details, for that has been done before. Suffice to say that the *Boadicea* is an unprotected cruiser of 3,300 tons displacement and is to attain a speed of 25 knots, the same as the "Scouts." She will be, however, 400 tons heavier than that class of vessel, which cost on an average £285,000 each, whereas the *Boadicea* will, it is estimated, cost when completed, £333,067. She is the third vessel of the name, both her predecessors having done good service in war time. The first, a 38-gun frigate, was introduced into the Navy during the French Revolutionary War. The second was a screw corvette of 4,140 tons, launched at Portsmouth in 1875. Her first captain was Sir Frederick Richards, who is now an Admiral of the Fleet, and parties from her landed at the Cape and took part in the

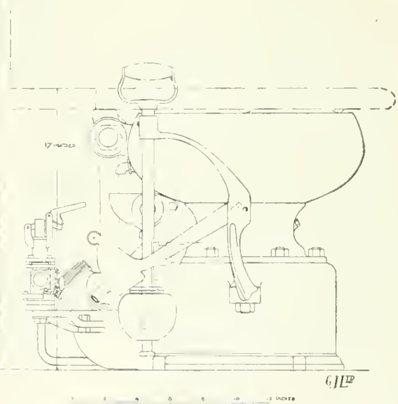
Zulu War of 1879, and the first Boer War. Later, in 1890, as flagship of Admiral Sir Edmund Fremantle, on the East Indies Station, she took part in the Vitu Expedition. The outer bottom of the *Boadicea* has been coated with a new patent anti-fouling composition, never before used at this yard. The vessel has been taken to Hobbs Point Pier and berthed under the sheer legs to receive her machinery and boilers. She is expected to remain there rather over four months. There seems to be no reason why the *Defence* should not leave here to be docked and prepared for her steam trials in June. It was at first feared that the anticipated non-delivery of the electric capstan would have necessitated an alteration in the programme. Despite the strike on the North-east Coast, I understand that Messrs. Clarke, Chapman & Co., the contractors, have managed to get the machine completed. I said last month that large quantities of material had been delivered here for our new vessel, and that preparations for laying her down were in active progress. At the end of April, however, instructions were received from the Admiralty directing that steps were to be taken to increase the displacement by fifty tons. This, of course, will delay the laying down of the ship, and other work has had to be found temporarily for some of the men it was proposed to employ on her. Larger numbers therefore have had to be kept on the *Boadicea* and on the fourteen "camels," which we are building for service at Dover. The non-effective cruiser *Medusa* is daily expected to arrive from Sheerness for the purpose of being fitted as a depot ship for calibration tests at Bantry. The extent of the work is not quite known, but whatever it is, it will help to tide over the emergency. It was thought a week or two back that the first of the torpedo boats which we are to refit would have arrived ere now. Hopes, however, are entertained that the Admiralty may find it convenient to send one or more of them here without delay. A pneumatic machine designed to clean rust off iron and steel plates, which has been invented locally, is being experimented with, and it is understood to have given satisfaction as far as the tests have proceeded. The annual entry examination for apprentices was held on May 12th and 13th at the Coronation School. There were eighty-five candidates for thirteen vacancies.

A knowledge of first-aid and ambulance work is very desirable for the officers and men on the mercantile marine, and we have noted with some measure of satisfaction that this subject has been added to the examination of the deck department officers, and will probably be added to that of the engineer officers. It appears quite as desirable and equally necessary for the engine-room officer to be in a position to act promptly in case of accident below as it is on deck, and we welcome the proposal.

ELECTRIC PUNKAHS.—We were favoured with an opportunity recently of seeing in action, fitted in the Saloon of a steamer, two of the electric punkahs made by Messrs. Bergtheil & Young, Ltd. These punkahs we have previously referred to incidentally as not only likely to rival fans for the purpose of cooling the atmosphere of saloons and cabins in the tropics, but to supersede them. The result of what we have witnessed has given confirmation to the impression conveyed by the sample punkahs exhibited at the engineering exhibition. The action is silent and the motion more than equal to the hand-driven punkah, while the electric current required is much less than that taken up by a fan. The measure of the current was taken and found to be ·5 amp. at 100 volts when the motor was started, when the inertia had been overcome and the punkah underway, the current was only about ·3. The whole appliance is neat and is the result of years of experimental work on the constructional details of the motor and its application, the desiderata of simplicity and efficiency to bring about the correct movement being only attained after many failures. It is interesting to note that the idea of a mechanically-driven punkah has been exercising the minds of many inventors for years, a large number of patents having been filed in connection with mechanism for driving them, hitherto these have not been successfully worked, due chiefly to failure in obtaining the correct motion, similar to that given by the punkah-wallah of the East. The punkah now referred to has been evolved as a result from the meeting of an old Anglo-Indian who was searching for means to give motion to his punkah, and an electrician who got it for him.

MESSRS. GEORGE JENNINGS LTD.

BY invitation of Messrs. George Jennings, Ltd. (the well-known sanitary engineers), the members of the Institute of Marine Engineers were afforded an opportunity of visiting the firm's extensive show-rooms at Lambeth Palace Road, S.E., on the afternoon of May 16th. The visitors were received by Messrs. Walter Jennings and John Morley (directors of the firm), whose lucid explanations of the various improved sanitary appliances and productions, for which this firm is so justly famed, proved most interesting and instructive. It is almost unnecessary to mention the high position attained by Messrs. Jennings, who have received the Royal Appointment of Sanitary Engineers to His Majesty King Edward VII., have supplied their specialities in sanitary appliances to the Royal palaces and residences of almost every European sovereign, and whose productions are to be found in every part of the world. The business was established in 1838 by the late Mr. George Jennings, since whose death in 1882 it has been carried on by his sons. Besides the works at Lambeth, giving employment to about 1000 men in the various departments, there are large works in Dorsetshire where suitable clay is found for the special manufactures of the pottery department. At the Lambeth works the

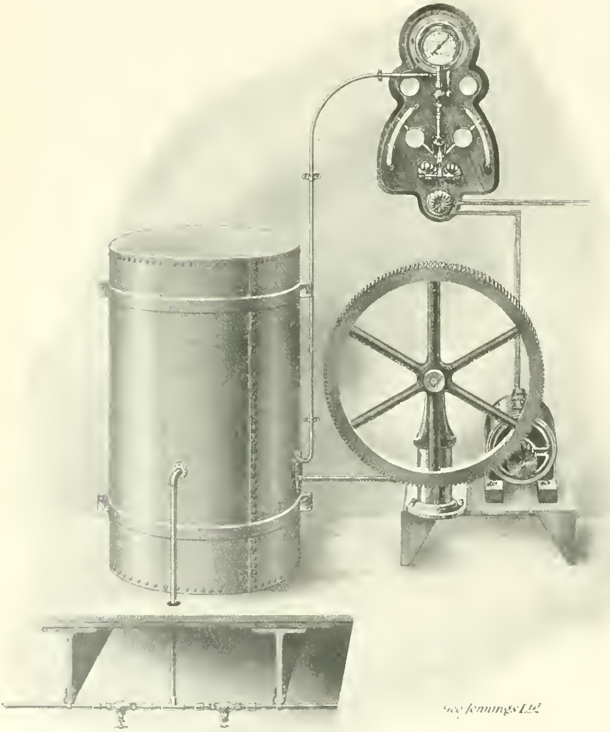


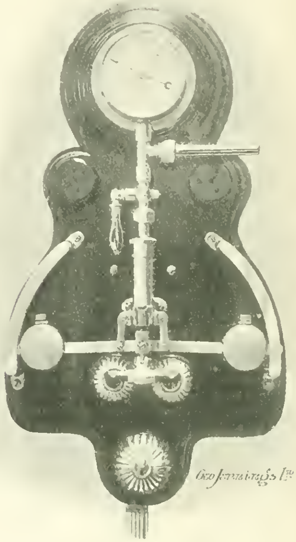
machinery is divided up into sections so that the maximum of output may be obtained with economy and good finish, cutting and polishing marble or wood, casting, finishing and fitting brass taps and connections, erecting the appliances preparatory to placing them on the market or despatching them to customers. The tour of the show-rooms impressed one with the amount of prolific ingenuity displayed in the details of construction and the widely varied field covered by the firm's inventions and productions; we, however, limit our notice to those which more immediately concern marine engineers.

We were especially struck with a most ingenious and simple arrangement of hot and cold supply and waste fittings for baths and lavatories, designed so that the cold water must be first admitted, thereby diminishing the risk of injury to the enamelled surface of the bath or basin, a risk attaching to the ordinary types of valves. Another important feature in these improved valves from the point of view of the marine engineer is the ready and convenient means of access to the working parts attained by the removal of four screws which secure the covers to the valves, so that, when necessary, repairs can be effected in a few minutes; the waste valve is also arranged for instant removal facilitating the cleansing of the fittings and waste outlet. Another clever contrivance is a gas-heating apparatus for supplying hot water, by which

the opening and closing of the water supply automatically controls the service of gas to the burners, thus minimising waste. We were greatly interested in an improved fire-grate for heating and ventilating rooms; the invention comprises a terra-cotta cellular chambered body immediately at the back of the fire-place, into which fresh air is admitted through an opening or grating in the external wall, and the air after passing over a series of warmed ribs of terra cotta is drawn into the room at an agreeable temperature to replace the vitiated air drawn out of the room up the chimney by the usual process of combustion. In addition to furnishing an increase of 40 per cent additional warmth in fresh air, the consumption of fuel is decreased by quite 20 per cent., while the supply of warmed fresh air is maintained in the apartment for about twenty-four hours, due to the heat-retaining property of the terra cotta after the fire is extinguished. These grates have been adopted in many important buildings, such as the Bank of England and branches, Kent County Council schools, offices and waiting rooms of the principal railway companies, etc.

Among many other varied specialities exhibited in action, the special systems of water closets designed for use on board vessels of every class were carefully examined and measured by the visitors. For above water-line positions Messrs. Jennings have introduced a new type of pedestal wash-down w.c. designated the "Pivot," with connections for water supply and drain arranged so that they can be attached in any convenient position. Where the closets are fixed close to the water level an ingenious form of balanced back valve is provided at the outgo of the closet, preventing the possibility of any back wash or escape of foul air due to waves entering the soil pipe. The *pièce de resistance* of the whole of the exhibits, from the point of view of the marine engineer, is an exceedingly novel, simple and perfect installation of water-closet apparatus for fixing below water-line, the contents of which when the handle is raised and lowered, is automatically ejected into the sea by air pressure discharge. For the purpose of keeping a pressure of air a reservoir is supplied, with a small motor attached, driving a pump electrically; the pressure is maintained by a very ingenious contrivance, as shown in the illustrations, actuating a switch automatically as soon as the air-pressure rises or falls beyond the prescribed limit which, for the purpose of demonstration, was set at 25 lbs. and worked admirably. Provision





is also made for working the pump by hand, should the electric current not be available.

The system has been adopted on the steam yachts *Amalthea*, *Agawa*, *Maund*, with signal success, and is now being installed on the new steam yacht *Iolanda*, the second largest yacht in the world. It is also in operation on the steam yacht *Valhalla*, R.Y.S., owned by the Earl of Crawford, and the invention bids fair to be very extensively adopted in situations where a below-water line system of closets is requisite, and is, therefore, well worth the attention and consideration of marine engineers and naval architects. Messrs. Jennings have had a large experience extending over many years in marine sanitary engineering, and have furnished the equipment of sanitary appliances for the ocean steamships of the Peninsular and Oriental, Royal Mail, White Star, Cunard, Allan, Union Castle and Orient lines of steamers, L. & N.W.

Railway, and other companies, in addition to a very long list of private yachts. It is also interesting to note that they have recently carried out the drainage and rearrangement of sanitary fittings in the London residence of one of the esteemed past presidents of the Institute, Lord Pirrie, whose firm has been one of Messrs. Jennings' customers for many years past.

After partaking of light refreshments our pleasant sojourn terminated, concluding with a very cordial vote of thanks to Messrs. Jennings, proposed by Mr. Aukland and seconded by Mr. McLaren, and responded to by Messrs. Walter Jennings and Morley, after which a brief discussion ensued on the various appliances which had been inspected, in the course of which congratulations were offered to Messrs. Jennings on the success of their efforts to combine simplicity, adaptability and efficiency in their manufactures. The standardizing and interchangeability of parts to admit of placing details of fittings on one side or another was also noted.

JAPANOL.

THE treatment of wood and iron work for the purpose of producing a decorative effect has undergone radical changes during the past few years, and the public has been educated to expect such an effect as average work which would years ago

Cabin of R.M.S. ship "Ambrose," decorated in Japanol

have been considered impossible except at a very high cost. This change is largely owing to the introduction of enamel paint, and while it has an undoubted superiority over old-fashioned paint, it has the additional advantage of being simple to use and convenient in form of supply.

An enamel paint to meet with ready appreciation must be brilliant, elastic, durable, sanitary, non-fading, washable, damp-resisting and rust-preventing.

One of these enamel paints, which has been placed on the market lately under the title of "Japanol," by the Japanol Enamel Company, Culford Works, London, N., appears to merit the appreciation of the public by complying in every respect with the conditions laid down above.

It has been proved by actual demonstration that Japanol will not crack, chip, peel, blister or fade, and will resist the influence of the sun, frost, heat, cold, sea air, water, gases, acids, weather and wind even under the most exposed conditions.

This paint is the result of careful experiments and scientific research into the decomposition of paints and pigments and the properties relating to them. As the resultant paint is intended for work of the highest class, it is made in one quality only.

As evidence of its extreme flexibility, we have tested some tin plates which have been coated with enamel and which were perfectly dry, and have bent them backwards and forwards many times without producing the slightest evidence of disintegration or cracking.

For ship decoration, enamel paint of this character has a very wide field, and judging from the use of it on some of the vessels of the "Booth" Line, it appears to give every possible satisfaction.

We show in the adjoining illustration a view of a cabin on the R.M.S. *Ambrose*, which has been decorated in enamel, the effect of which is very pleasing. A considerable number of the vessels belonging to the Pacific Steam Navigation Company, and also three vessels belonging to the Canadian Pacific Railway Company, have been decorated with this paint, and we are satisfied that its merits only require to be known for its use to be very widely extended.

S. T. TAYLOR & SONS have covered boilers, pipes, etc., of the s.s.'s *Penrose* and *Belle Ile* with their "Tynos" non-conducting material and covered boilers, cylinders, etc., with their "Tynos" non conducting material, and supplied their "Tynos" asbestos mattresses for the three boiler bottoms of the s.s. *Servian*.

IRON AND STEEL INSTITUTE.—As announced, the Canadian Mining Institute has extended to the members of the Iron and Steel Institute a cordial invitation to take part in the summer excursion of that society in Canada. Arrangements have now been completed for carrying out the programme, and it is proposed that the excursion shall start from Montreal on August 24th.

THE INSTITUTION OF MECHANICAL ENGINEERS.—The conversazione in connection with this institution was held at their premises, St. James' Park, W., on Friday, May 15th. A reception was given in the large hall by the President, T. Hurry Riches, Esq., a programme of music and song was provided; electrophones were also at the service of the guests, and a special feature of the evening which was highly appreciated was a lecture by Mr. R. N. Reddie, with lantern illustrations and records from the gramophone by Tetrazzini, Caruso and others, the subject being sound waves and sound reproduction.

ELECTRICITY ON BOARD SHIP.

XVII.*

By Sydney F. Walker, R.N., M.I.E.E., Assoc. M.I.C.E., etc.

Arc Lamps suitable for Cargo Lights.

The arc lamp most suitable for cargo lights is, taking everything into consideration, the open arc lamp. As explained in a previous article, the lamp requires a pressure of 50 volts, and works usually with a current of 10 ampères, or thereabouts, so that it is necessary either to work two lamps together or to waste the pressure that is employed in furnishing one of the arcs, in some form of artificial resistance. An artificial resistance can easily be rigged up by an electrician, or by anyone who understands the running of arc lamps. A length of No. 16 iron wire, coiled into a spiral, and rigged up anywhere, stretched in air, in such a position that it will be out of the way of men working and will not easily touch any metals or wire ropes about the ship, will answer the purpose. In cases where a single lamp is wanted quickly this method will probably be as handy as any. The firms who make arc lamps also supply adjustable resistances, consisting of wire coiled on porcelain or other insulators and enclosed inside of cases, and so arranged that the case can be fixed in any convenient position. It is much the best, however, to use the two lamps, taking the full pressure of the service. Two lamps are always better than one for cargo work. A single lamp casts awkward shadows in certain directions, and the second lamp is often very useful to illuminate the shadows. Thus, when cargo is being hoisted out from a single hold, say the fore hold, a lamp forward of the hold and another abaft the hold, should give very good results, so far as lighting the deck, the hatchways, the side of the ship and the wharf or dock side.

The enclosed arc lamp, as explained gives less trouble than the open arc, when the run is to be for a considerable time, as in the case of lighting a street or a dock side, night after night, week in, week out. But as cargo work can only go on for a certain number of hours at most and as it is quite easy to take the lamps down and retrim them and clean them between the runs, there is really no great advantage in the use of the enclosed lamp. In addition, as mentioned in a previous article, the enclosed lamp must have special carbons, which are not always obtainable at the ports where the ship may be unloading. The enclosed arc lamps on the other hand, are always fitted with adjustable resistances, and therefore can be rigged up at any convenient spot, a pair of cables brought to them and the lamp started right away without any trouble.

The flame arc lamp, though, as mentioned in a previous article, it should be of great service when loading or unloading certain classes of cargo, providing that the carbons employed are impregnated with the salts, giving what the writer has found practically pure light, have hardly sufficiently established themselves to warrant their being used for the rough and tumble work on board ship and in particular during the rush of loading and discharging cargo.

The Supply of Current to Arc Lamps.

Both search-lights and cargo lamps can be supplied with current either from separate dynamos or from the main generating station. In either case all that is necessary is that a pair of cables shall be brought from the main switchboard to some convenient position near where the lamps are to be employed, and there a connecting box fixed. The connecting box should be enclosed in an iron case, and the arrangements inside it would consist merely of blocks of metal with screws to receive the cables from the main switchboard screws to receive the cables leading to the lamps, and a pair of fuses. It may also, if required, contain a switch. The current will be led from the connecting box to the arc lamp, either by a pair of cables or, preferably, a single cable containing the two conductors and made up in a flexible form. It was explained in a previous article that cables are made up by stranding six wires around a seventh, twelve wires around the outside of the six, and so on. But cables made of seven, nineteen or thirty-seven wires, as usually arranged to carry the currents required by arc lamps, are not very flexible. Single cables of seven No. 16 wires are moderately flexible, but cables of nineteen No. 16 wires are not at all flexible. For special work, such as conducting the current to arc lamps in out-of-the-way places, special cables are made up, in which the conductors are very much more flexible than the usual stranded arrangement. In place of the seven No. 16 wires, each of the wires is replaced by a number of very much smaller wires, stranded together, the stranded wires then being stranded around each other, just as the solid wires are. And, further, cables are made in this way in which the section of the conductors is a semicircle, or something approaching it or again something in the shape of a crescent. Each conductor is formed of a number of small wires, and is therefore very flexible, and is separately insulated. The two insulated conductors are then laid together, to form the usual cylinder, insulating material is laid on outside of the insulation of the two, a little padding is added, and the whole is covered with braid and similar substances. The case of the conductors for arc lamps is very similar to that for coal-cutting machines in mines. For coal-cutting machines conductors are laid up in the manner described above, and are then sometimes covered with a braid of strips of leather. The leather is flexible, comparatively strong, and the finished cable is easily handled and not so easily damaged as a pair of cables insulated with rubber in the ordinary way, or some of the flexible cables that are supplied.

Incandescent Lamps.

The incandescent lamp is *par excellence* the lamp for board-ship work of every kind except for search-lights. It is made in all sizes, from five candles up to 500 c.p., in forms suitable for use on board ship, and the higher c.p.'s, 100 to 500 c.p., are very much more suitable for loading and discharging cargo than arc lamps, because they are so much more easily rigged up and require so much less attention. On the other hand, for a given amount of light, they require many times the current that the arc lamp does. Hence where the generating station has been cut short, and a number of lights are required about the ship, at the time that cargo is being taken on board or discharged, apart from the cargo lights, arc lamps are practically necessary, as it would not be possible to obtain sufficient light with incandescent lamps in the majority of cases. Wherever they can be employed, however, incandescent lamps are much the best. The incandescent lamp can be taken into any part of the ship, to the cabins holds, bunkers, even the bilges, and in fact to every place where a light is required, and all that is necessary to obtain a light with the incandescent lamp is to bring a pair of wires, or in the case of the single-wire system, a single wire to the place where the light is required, to connect the wires to a lamp holder there and to slip the lamp into the holder. It is wise in all these cases to have a switch to turn off any lamp and also a fuse to protect the wires leading to the lamp, but these may be fixed at different points about the ship to which the main cables or first branch cables are brought, and from which wires may be taken for any lamps that are required. Further, any quantity of light that may be desired can also be obtained, in any position, by simply fixing the lamp that gives that amount of light. Thus, in the bunkers, for instance, in a great many cases a five c.p. lamp would be sufficient. If, however, more light is required, the five c.p. lamp can be slipped out of the holder and an eight c.p., say, put in its place, and if that is not sufficient, it can be removed and a sixteen c.p. or thirty-two c.p. fixed, as the case may be. Each lamp automatically takes what current it requires to furnish its proper light, and obtains its proper current, provided that the cables and wires leading to it are properly proportioned. In the case sketched above the wires provided for a five c.p. lamp would be, for mechanical reasons, strong enough, or ought to be strong enough, to furnish current for a thirty-two c.p. lamp; and hence all that is required to give more or less light is to change the lamp.

It should be mentioned that an incandescent lamp must not be embedded in coal, nor allowed to collect much coal dust on its globe, as the temperature of the lamp is very high and will ignite coal dust.

* For Articles I. to XVI., see previous issues.

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions of our correspondents.

The Testing of Galvanized or Zinced Iron.

To the Editor of the MARINE ENGINEER AND NAVAL ARCHITECT.

Dear Sir,—It is a matter of considerable importance to engineers who use galvanized iron to know the amount of zinc that is applied per square foot of the surface; the thickness of zinc has hitherto been determined almost universally by the copper-sulphate test, known as Preece's test, which consists in placing the galvanized iron in a saturated solution of copper sulphate for one minute and continuing the immersions until it shows a red deposit of copper, which is a true indication that the zinc has been penetrated and the iron exposed. This test when carefully carried out is fairly reliable as regards hot galvanized iron but it is found quite useless for the more recent forms of galvanizing which are now being extensively used by large manufacturing firms and the Government, namely, electro-galvanizing and Sherardizing for the following reasons:—

On applying Preece's test to Sherardized and hot galvanized articles coated with an equal thickness of zinc the former require from three to four times the number of immersions which suffice to remove the zinc from the latter. When hot galvanized articles are placed in a saturated solution of copper sulphate the copper is precipitated in a loose form, but when Sherardized, Cowperized or electro-zinced articles are similarly treated the copper adheres firmly to the zinc and no fresh surface is exposed apparently due to the deposit of zinc applied by the electro-zincing, Sherardizing and Cowperizing processes having a fine matted surface.

It would appear from these observations that the apparently great resistance to corrosion of Sherardized iron when subjected to Preece's test is due to the protection of the zinc by the deposited copper, so experiments were made with a solution of ferric sulphate which dissolves zinc without forming a precipitate on the zinc coating. To test this known areas of Sherardized and hot galvanized plate were exposed to the action of ferric-sulphate solution for an equal period and the amount of ferrous salt formed by the reducing action of the zinc determined.

The column headed "Weight of zinc dissolved" shows the relative corrosion:—

Nos	Sample	Zinc per sq. ft grams	Weight of Zinc Dissolved. grams
1.	Sherardized	26·908	.... . 0·080
2.	Sherardized	26·908	...... 0·074
3.	Sherardized	22·93	... 0·057
4.	Hot galvanized ...	22·12	.. 0·058
5.	Sherardized	31·116	. . . 0·034

Sample No. 2 was moistened with water and allowed to dry; the oxide formed appears to protect the zinc and this protection is more marked if water is allowed to act for a longer period than was permissible in these experiments. It will be noticed that samples 1 and 2, which had a thicker coating than samples 3 and 4, dissolved to a greater extent than sample 3, and which had practically the same weight of zinc coating dissolved; sample 5 was Sherardized copper, and although the zinc coating was the heaviest, yet the corrosion was in this case the least, probably due to the conversion of the greater portion of the zinc into brass. On testing this sample with copper-sulphate solution, as in the other cases, instead of a brown precipitate of copper a bright metallic deposit was obtained and no further action seemed to occur.

From the results of experiments, the copper-sulphate test has been found to be quite unsuitable for testing electro zinced, Sherardized or Cowperized surfaces, therefore it will be necessary in future to substitute some other test such as the ferric-sulphate test or a modification of the copper-sulphate test.—I remain, yours truly,

SHERARD COWPER-COLES.

London, May 5th 1908.

PARAGRAPHS.

PERSONAL.—We regret that owing to continued ill health, Mr. H. R. Chapman has been obliged to resign his position as chairman of Messrs. Clarke, Chapman & Co., of Gateshead, and has been succeeded in that office by his co-director, Mr. H. Walker.

SYREN.—On the morning of the 25th May, the ketch *Syren* caught fire in the tidal basin of the Ship Canal, at Runcorn, and the after part of the vessel was completely gutted. She had only been in the possession of Mr. C. H. R. Harrison, of Manchester, a few days and was not insured.

THE CURIOUS ANOMALIES which one meets in daily intercourse with his fellows, are occasionally very striking and set up a train of reasoning not unprofitable as a mental exercise. In a recent issue of a journal advocating the encouragement of the home industries two excellently equipped steamers, which had arrived within their territorial waters to trade therein under the house flag of one of their own companies, were referred to. As these steamers had been built on land washed by other seas than those claimed as their own, it was more than hinted that a 50 per cent. duty should be imposed in such cases, with the object of rousing up local talent to build steamers suitable for the trade at a figure approaching the actual cost of those built, say, in Britain, plus the proposed duty. One obvious result of this would be to place a fictitious value on all steamers trading on their coasts, a result which would hardly be conducive to the general prosperity of the people. The value of a steamer is what she will bring in the open market, according to her fitness for the requirements of trade at the time of the negotiations, and no bulling or bearing will have any effect upon this. The general prosperity of a country is largely assisted by, if not actually dependent upon, the economical cost of transit, whether by land or water, and any attempt to raise the cost of the appliances by which the transit is affected will prejudicially affect that prosperity. The farmer and agriculturalist are hindered by the high cost of transit, due in some measure to the enhanced value paid for the land by the railway company, and also the large capital outlay for construction. Generations following may suffer hardships and be placed at a disadvantage by one generation setting an abnormal value upon land or other property, thus increasing the necessary capital outlay on which a return requires to be made to the investors. It is reasonable, if one desires to be located in a quiet retreat, to object to the noise and bustle incidental to machinery or railway plant being placed upon the property around, and if needs must, to yield only after the matter has been referred to a third party for adjudication; but beyond this there have been experiences where the double advantage has been gained of an abnormal value being paid for the land, with the further gain accruing from an enhanced value placed upon the remainder of the property by the added facilities of travel and transit. In the case of a duty upon steamers the result would probably be that in place of two steamers being built there would be but one, on account of the capital necessary, involving also the employment of fewer hands with harder and more severe work, a lessened service, with an added cost for transit of goods and passengers, tending to enhance the cost of all marketable goods thus carried, and keen cutting in order to make ends meet—to give a return on the outlay. Another result would follow in the purchasing power of money being lessened, so that one who could make a fair return on his capital elsewhere would require to increase it under the conditions advocated and with lessened prospects of success. The element of fair competition keeps active the inventive and the methodical faculties, it also stimulates the faculty for improvement. The manufacturer or the trader who thinks he can afford to jog along as his fathers did, in these days will fall short in his estimates. It is not only necessary to have a good name handed down from the past, to advertise specialities and changes in details of manufacture, but to keep up to date in all the tools and appliances for manufacturing in the best possible way on best modern lines and in a well-equipped workshop. The traditional good name used as a fetish has brought not a few to grief; the protection of a trade or manufacture lies in improvement, not in bolstering it up on old lines or by fictitious means.

ELECTRICAL NOTES.

(From our Own Correspondent.)

Electric Galvanizing.

MOST engineers are familiar with the ordinary process of galvanizing in a hot bath, but it is perhaps not known that electricity affords a ready means of conducting the process. The methods employed are first cleaning the surface or the "pickling," which is done by immersion in a solution of hydrochloric acid before putting in the plating vat. Then, taking the case of a condenser tube, which requires plating on the inside, an anode has to be led down the centre of the tube and the other—a tube—encloses the one being treated. Insulating caps are employed at the ends and means for circulating, the electrolyte current is led to the plating vat and this is kept up to normal strength by a process of regeneration, that need not be described. At first the current must be as high as possible and afterwards reduced to about 15 ampères per square foot. The dynamo should have a capacity of 1,000 ampères at 6 volts, and this will be sufficient to galvanize pipes of 8 in. bore and 20 feet long, with a thickness of, say, 1½ ounces per square foot and to turn out, say, sixty such tubes in a working week. It is obvious that electrical deposition is a better method than that ordinarily practised, as it is regular and therefore a more even surface should be the result, with a closer body right through for offering resistance.

Electrical Cranes at Hamburg.

The inauguration of the new docks at Hamburg has led to a great use of electricity for crane purposes. Indeed it is said that the installation is the largest of its kind in the world. For instance, there are 134 cranes of the portal type at the Kuhwaeder Dock, the specification of which was: normal load, three tons, distance between centre of lifting rope and quay wall, 9½ yards; from centre of crane to centre of lifting rope, 12 yards. Maximum lift, 26 yards; radius of lift, 10 feet. With a load of 1 ton and a skilled operator, fifty cycles of operations have been performed in the hour, and under these conditions, the motor does not show any signs of heating. The lifting of 1½ tons was done at a speed of 65 yards per minute and with 3 tons, 52 yards. The supply is 440 volts direct current and the efficiency varies from 84 with 10 B.H.P. to 81 with 50 B.H.P., the revolutions decreasing in the meantime from 550 to 232. The distance between the rails on which the cranes travel is 15 yards and with such a number of cranes and the radius of action that each has, some idea will be given of the vast arrangements provided. In addition, there are fifty-four half-portal cranes in the Docks, the travelling platform in this case being nearer the ground level than in the former case, but the distance between the rails is greater. Such an installation emphasizes the facilities afforded at the German port for loading and unloading cargoes.

Wireless Telegraphy.

Simultaneously with the issue of the Marconi Co.'s report, which points to considerable activity, we have a paper by the inventor, whose name is so prominent in this connection, which explains the present position of matters in this branch as far as the Company is concerned. The difficulty mentioned is still that of passing from dark space to light space in the great distance across the Atlantic and also the effect of storms. Darkness strengthens the waves and *vice versa* light weakens them. Change of any kind seems to have a deleterious effect as with rough weather following fair. Still enormous progress is reported and the stations on this and the other side of the Atlantic are models of their kind. We are promised great things, but in the meantime 68,000 words are said to have been transmitted by the New York Times in five months from this side and published in the paper as news. It is reported also that communication was made by the *Caronia* with Glace Bay (Nova Scotia) when 2,260 miles distant and at the same time kept up with Clifden (Galway), 930 miles away.

Electrically-driven Machine Tools.

We have in this column previously referred to this matter, but new developments are continually taking place. An instance noted is that of a shaping machine in which the driving is by an 8 H.P. alternate current motor through a change gear box. The changes are made by sliding gear and friction clutches operated by levers, so that changes of speed can be readily made by operating the levers. The same with milling machines. The motor is totally enclosed, so that there is no danger of cuttings getting in to affect the working in any way. In fact, as regards machine tools generally, the electric motor has evidently come to stay, judging by its very general adoption.

Motor Launches.—Four new designs for fast motor launches were sent out lately by Mr. James A. Smith, M.I.N.A., including Mr. Scott Hayward's 50 H.P. Antoinette racing boat; a 26-ft. speed launch for the Trent, to be built by Mr. A. J. Witty, of Nottingham, and fitted with a 12 H.P. Wolseley motor; a new 25-ft. racer for an Australian owner, with a 45 H.P. 6-cylinder Brooke engine; and Mr. Warwick Wright's 8-metre M.Y.C. restricted boat *Lurgique*, with a 4-cylinder Metallurgique motor of 45 H.P.

"Kelvin II." a new racing launch designed by Mr. J. A. Smith, M.I.N.A., has been built and engined by Messrs. The Bergins Co., Glasgow, in the record time of eighteen days. The model is a very pretty one, and some excellent speed results have already been obtained, there being practically no wave-making at any speed. The boat is 23 ft. long and has a 14 H.P. Kelvin motor. It is understood that her owner will race her at all the Clyde meetings this season.

The Exhibition held in the Agricultural Hall, Islington, from May 1st to 12th on municipal and public health appliances, besides containing many exhibits of general interest illustrative of progress in buildings, building materials and in difficult problems connected with efficient drainage and treatment of sewage, also contained a few machines and auxiliaries of special interest to marine engineers. The hall was well arranged, there was ample space to examine everything at close quarters and one could scarce realize that we in this same building had formerly witnessed the military tournament, and more recently the Palestine Exhibition. The Ladies' Instrumental Band discoursed sweet strains to enliven the proceedings, while views of Niagara Falls and Rapids by cinematograph pleased the eye, adding a charm to the whole, the more so as the pictures could readily be seen without either the risk of one's favourite corn suffering by the pressure of over-eager zealots, or the usual extra fee for side shows being demanded. We enjoyed the views of Niagara; so good were the films that the ear was in harmony with the eye and one all but heard the sound of the rushing waters. The heating boilers exhibited by Messrs. Meyer & Co. are neat and compact, the design is carefully thought out and the details of the construction calculated to give high efficiency with economy in working. Jeye's Sanitary Compounds Co., Limited, had a good show of their specialities, and amongst them several which were of value for engine-room use. The Helios adjustable die stock by the Union Standard Machine Co., and several other tools shown by this firm were worthy of examination and note. Messrs. Boulton and Paul, Limited, Norwich, exhibited specimens of their work as steel-boat builders and marine-motor makers, combining simplicity and good workmanship; in the motor they advocate the two-stroke engine for marine work. The tools and samples of work done by some of their special drills for large pipes, at the stand of Messrs. John Ruscoe & Co., Limited, called for more than a passing glance, and we would fain pay a visit to see these in operation at some future time, should opportunity serve. The great variety of boilers for heating apparatus, manufactured by Messrs. Heenan & Froude, and the valves and fittings connected with such, both for steam and water, were fully illustrated in their catalogue and samples were on view at their stall. The Hotchkiss boiler water cleaner and circulator was shown in model, so that the action could be seen and the results exposed to view. The sediment from various waters extracted by means of the apparatus showed its efficiency in removing scale-forming elements which otherwise would require to be removed by hand labour and from the heating surfaces with the boiler emptied. The organizing managers of this exhibition were Messrs. Smith and Bridges, who also organized the engineers' exhibitions at Olympia.

MODERN TORPEDO BOATS AND DESTROYERS.*

By J. E. THORNYCROFT Esq., Associate.

SINCE the introduction of the torpedo-boat destroyer rather more than twelve years ago, such changes have taken place in their construction, and the torpedo boat itself has been enlarged to such an extent, that a review of the developments may be of some value.

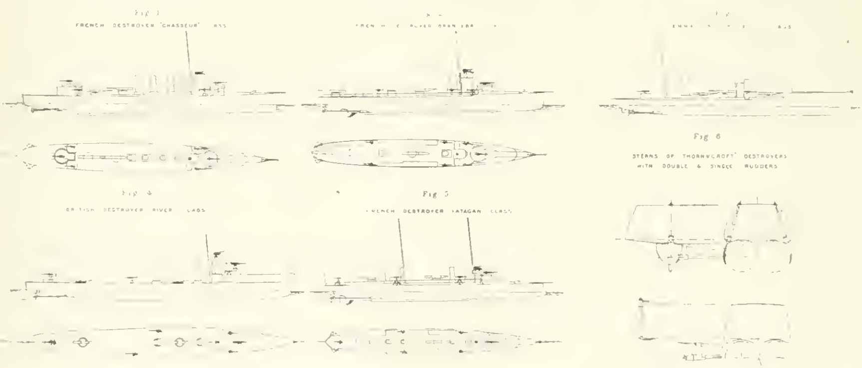
Considering the vessels of the British Navy, it will be found that the largest torpedo boats were vessels of about 130 tons displacement and 2000 I.H.P. developing a speed of 23 knots. They were, with one exception, single-screw boats, and were, except in a few cases, fitted with locomotive boilers. The majority of the boats were considerably smaller, and only had a speed of about 20 knots. The only watertight compartments were formed by the bulkheads—watertight flats in the compartments at the ends of the vessels not having been at that time adopted. The most powerfully armed were fitted with one bow and two deck tubes for 18 in. torpedoes, and three 3-pounder guns.

At the same time the French and German navies possessed a large number of torpedo boats of about the same size and power, but differing greatly in design from the British boats. The French design of boat came primarily from the yard of Normand, and the German from that of Schichau. In addition to their torpedo boats, the German Navy possessed a number of much larger and more powerful boats, which were called "Division" boats. These were employed with the torpedo boats, and carried the commanding officers of each division. Although they were vessels of considerable tonnage, being over 300 tons, they did not develop a much greater speed than the torpedo boats.

The history of the inception of the torpedo-boat destroyer in the British Navy is so well known as to require only a passing reference. The efficiency of machinery which had been fitted to the torpedo-gunboat class being insufficient to enable them to develop a higher speed than the torpedo boats, the British Admiralty decided that vessels of the torpedo boat type should be built of sufficient power and dimensions to ensure their being able to always overtake and destroy torpedo boats with the guns they carried.

The first vessels of this new class, which were called torpedo-boat destroyers, were built by Messrs. Yarrow (*Havoc* and *Hornet*) and Messrs. Thornycroft (*Daring* and *Decoy*). Their trial displacement was about 240 tons, and the power developed was over 4000 I.H.P., which gave a speed of 27 knots. They had a high freeboard, were excellent sea boats and were able to maintain their speed in rough weather. Although in dimensions they were somewhat smaller than the German division boats, their greatly increased speed gave them a much higher fighting value, and they were considered such a success that forty more were put in hand during the next two years. It was the introduction of water-tube boilers in these vessels which primarily enabled this high speed to be obtained, and their working was so successful that they were at once adopted by every builder of this class of vessel.

During the next few years the experience gained with them, when keeping at sea for considerable periods, made it desirable to increase the size and power, and six years after the first boats were built the new vessels that were being put in hand had been increased in size by about 100 tons, and the power from rather over 4000 to 6000 I.H.P. Their strength and safety had been very much improved by the introduction of water tight flats in the end compartments. The bow torpedo tube had been dispensed with, and their speed had been increased to 30 knots by the employment of high tensile steel in their hulls, and improvements in their machinery. The earlier vessels were constructed of steel of the character usually employed in ship construction, but the high-grade steel employed in these later boats had a tensile strength of between 37 and 43 tons, and was so tough as to show an elongation of 15 per cent. on an 8 in. test piece. The employment of this steel was a very important departure, as it enabled 15 per cent. of the weight to be saved in the structure of the hull. The stresses in the hull were about 9 tons in tension



and $7\frac{1}{2}$ tons in compression. Perfectly satisfactory results were obtained, and trouble was only experienced in some isolated cases where local stiffening or compensation had been insufficiently considered. During manœuvres, and in making long passages, some instances occurred in which it was thought that greater strength might be advantageous, but the damage sustained was not greater than might have been expected to happen to any vessels under similar circumstances. The fact that all the Japanese destroyers built by British firms made the voyage to the Far East, were at once put into service without any repairs, and went through the war without developing any structural defects, proves that this class of vessel was of ample strength.

After the British Navy had taken the lead, we find that the more important foreign navies quickly followed its example. The new division boats in Germany were built with water-tube boilers, and at once became available as torpedo-boat destroyers. There is however considerable difference between these vessels and the British, the German vessels having a very much lower freeboard, and drawing more water, besides being fitted with a submerged bow tube.

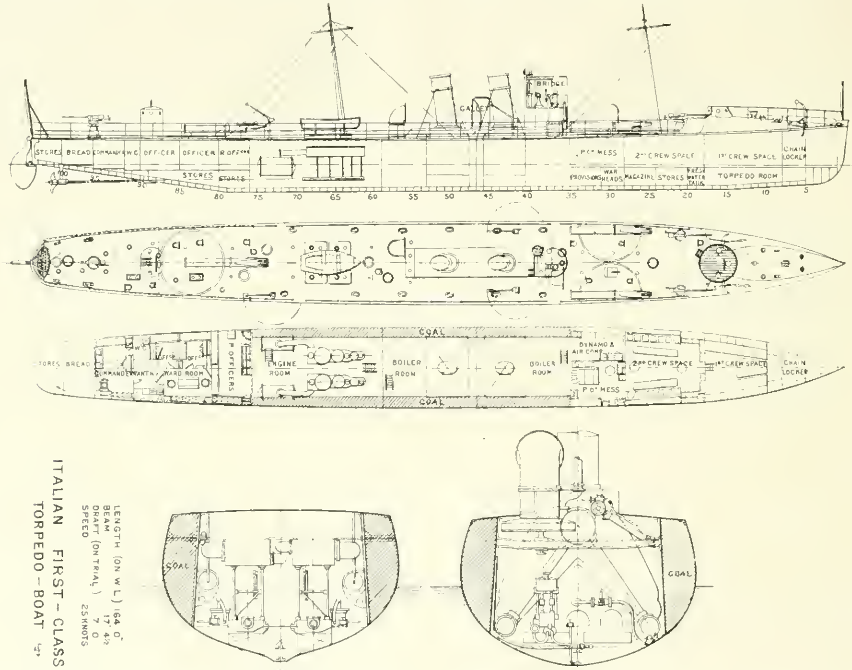
Mr. Ziese says that the attention of his firm (Messrs. Schichau) is specially directed to designing their vessels to be as low as possible in the water to reduce them to the minimum target. It will be seen from the comparative designs that the typical German vessel (Fig. 3) is certainly much less prominent in this respect than the later British vessels (Fig. 4). The German vessel is a good deal finer

* Read at the Spring Meetings of the Forty-ninth Session of the Institution of Naval Architects, April 8th, 1908.

forward, and the greatest beam is placed further aft; the stern is deep and narrow, quite unlike the broad, flat British sterns. The bridge is kept back as far as possible, being quite close to the forward funnel, one or more deck tubes being placed in front of it, and behind the low turtle back. This is, no doubt, a good position for them from a control point of view, but it is thought doubtful if they can be so efficiently worked in bad weather as the British vessels, with their greater freeboard and the torpedo tubes aft.

The destroyers built in France (Figs. 1, 2 and 5) have also a very low freeboard compared with the British boats, and possess quite a special construction of hull. The late Monsieur Normand, and some of the leading French naval architects, were of opinion that much greater strength and security in bad weather were obtained by constructing a vessel with a turtle-back form from one end to the other. This form originated with the Normand torpedo-boats, and was developed to such a degree of exaggeration in the French destroyers that a platform or hurricane deck had to be provided to enable the crew to work the guns and get from one end of the vessel to the other. The hatchway coamings, skylights, etc., are all brought up to this platform, so that the seas can wash over the deck of the vessel—the crew standing above the water. No doubt a considerable amount of weight may be saved by this construction, but it is doubtful if the vessel can be so efficiently worked in bad weather as one with a much greater freeboard. It must not be forgotten that a type of boat may be suited to one class of sea and coast, although not successful in another, and the French type may be all that is required for the Channel, but would not do so well for the North Sea or the Atlantic. Monsieur Normand has informed the author, however, that in the latest destroyers of large dimensions which he is building he has abandoned this special construction, and has adopted much more the British type, as will be seen from Fig. 1, which he has kindly supplied, showing one of his latest vessels. It is understood that this change is not in any way because the construction is unsatisfactory, but simply that it is less suited to larger vessels, and is more costly. In support of the advantage of what may be described as the British type of vessel, it is interesting to note that besides the Japanese, most navies that have built destroyers have adopted British designs. The British Naval authorities have considered the efficiency of destroyers in bad weather to be of such importance, that in 1901 it was decided that, in the new vessels, speed should be reduced to the extent of $4\frac{1}{2}$ knots, to obtain better sea-keeping qualities, and greater strength of hull, and more comfort for officers and men. These vessels were known as the "River Class" (Fig. 4), and while opinions differ as to their fighting value compared with that of the earlier 30-knot boats, it has been conceded that the reduction of speed was too great. There has been no falling off in the demand for high speed in vessels built by foreign navies, and the latest destroyers built for the British Navy have been designed for a speed of not less than 33 knots.

The River Class destroyers have a displacement of 525 tons and develop about 8000 I.H.P., which gives a speed of $25\frac{1}{4}$ knots. Not only are they of greater freeboard and beam, but have a high forecastle, the deck of which is about 14 ft. above the water. This makes them very comfortable and roomy boats, but, of course, much more conspicuous. Vessels with hulls of this type are now being built for a foreign navy, where they will be required to work in very open water, and they have also been proposed for the Australian Commonwealth, where similar conditions prevail. The officers who are responsible for this decision have also made the proposal to put the officers' quarters in the fore part of the vessel. The suggestion has often been considered before, but could not be carried out satisfactorily without the extra room provided by the double forecastle.



SECTION AT FRAME 65 LOOKING AFT   SECTION AT FRAME 59 LOOKING FORD

Reference has been made to the kind of stern adopted in the majority of the German vessels being different from what has been described as the "British type." The form of stern necessarily largely determines the type of rudder that can be fitted. As in other matters, there appears to be considerable difference in opinion as to the amount of steering control

which is necessary. The diagram Fig. 6 shows a broad stern and double rudders as fitted to the first of the destroyer class, *Daring*, etc., which was copied from the earlier Thornycroft torpedo-boats. The arrangement of two rudders, on either side of the screws, probably gives the best possible steering qualities, both ahead and astern, but has the disadvantage of the complication of two rudders.

It will be seen that the German type of rudder, as fitted by Messrs. Schichau, is very much more of the ordinary cruiser type of balance rudder. In some of the fastest of the French boats the rudder has been fitted forward of the screws, but in the later vessels it is arranged like the British boats, with the rudder spindle outside the stern of the vessel. Opinions differ very much as to the advisability of protecting the rudder, which may be done by placing it under the stern or by means of an overhanging counter, but if either of these methods is adopted it is much more troublesome to unship the rudder, than when it is placed clear of the vessel.

The difficulty of steering astern with a single-screw boat is thoroughly understood, and on this account alone there is a strong argument in favour of twin screws for all torpedo craft. The speed at which torpedo craft should be required to be controlled astern is one which must be fixed by naval officers. While the very best stopping power will be recognised as of the first importance, it is thought questionable if the steering gear should be required to control the vessel at more than 20 knots astern.

The new 33-knot type of destroyer, of which five have been built, and seven are in course of construction or about to be put in hand, are of between 800 and 1000 tons displacement, and are nominally of about 15,000 I.H.P. Experience gained with the experimental vessels *Albatross* and *Express*, intended for a speed of 32 knots, seemed to show that with reciprocating engines it would be very difficult to develop higher speed, and therefore in these new vessels, where 33 knots were demanded, it was decided, in view of the favourable results that had been obtained with Parsons turbines in the several torpedo-boat destroyers in which they had been tried, to adopt them for the new vessels. It is now generally known that, in conjunction with oil-fired boilers, the turbine engines have given results which could not have been obtained without their adoption. The *Tartar*, the fastest of the class, has maintained a speed of 35·36 knots on a continuous run of six hours, or practically 10 knots more than the River Class could maintain on a four instead of a six-hours' trial. While giving every credit due to the turbines and oil fuel for the part they have played in enabling this result to be obtained, it will be agreed that the greatest credit is due to Mr. S. W. Barnaby and the other officers of the firm who have been responsible for the design and building of the vessel. The increase in size over the earlier types, which has been found necessary to enable this speed to be obtained with the required raidius of action, has been very considerable, the length in the case of the *Tartar* being 272 ft. as against 225 ft. in the River Class, and the displacement nearly 900 tons instead of 600 tons. It is worth noting that the strength and proportions of all the individual parts have been kept up to the standard of the River Class, and the stresses in the structure of hull do not exceed 8 tons in tension and 6½ tons in compression, these being the limits which have been laid down by the Admiralty as necessary for this type of vessel.

Apart from the coal capacity of a destroyer the duration of time for which full speed can be maintained depends on the length of time it is possible to run without cleaning the fires, which at full speed, with average coal, is not more than three or four hours. With liquid fuel stoking is reduced to a minimum, and full speed can be maintained as long as the fuel lasts. The importance of the most skilful attention to reciprocating engines is well known. With turbines, both the number of men and the closeness of attention are very greatly reduced, and it is considered that the difference which has been made by the use of turbines and liquid fuel in these vessels has had as great an effect as the introduction of the water-tube boilers in the first destroyers. The extent to which destroyers of this power will be adopted by foreign navies is uncertain in view of their very great expense, and in their programmes it will be found that vessels of what may be described as an improved British 30-knot class are being adopted.

While the destroyers have been shown to have increased in size and power very greatly from the original type, the torpedo boat has developed almost to an equal extent. In each succeeding order for the British Navy torpedo boats have been made rather larger than their predecessors, until the last reciprocating engine boats ordered in 1903, which were of 200 tons displacement and 2900 I.H.P., gave a speed of 25½ knots; they carried three 18 in. torpedo tubes and three 6-pounder guns. The latest types of torpedo boats were ordered in 1905, and were at first called "coastal destroyers." They carried the same torpedo armament, were of slightly greater dimensions, but were fitted with turbines and oil fuel, and as far as power and speed are concerned they are practically the same as the first 27-knot destroyers. The adoption of oil fuel, however, has given them a much greater radius of action at full speed.

While the turbines have given excellent results in these vessels, it is a question if equally good results would not have been obtained with twin-screw reciprocating engines and oil fuel, as, while the merits of turbines for larger vessels are admitted on all hands, there is considerable doubt, when powers of less than 3000 or 4000 I.H.P. are required, if the greater simplicity of reciprocating engines is not to be preferred. The necessity of adding a cruising turbine, and, owing to the high speed of revolution, of adopting at least three shafts, makes it extremely difficult to arrange the engine-room satisfactorily in such small vessels. No doubt with experience it will be found possible to simplify to some extent the arrangement of pipes and auxiliary engines, but in their present form these adjuncts amount to so much that the fitting of the machinery on board becomes an extremely costly matter, and when it is necessary to open up, an enormous amount of work is entailed. It is thought that it will always be found necessary to put these vessels in dockyard hands if any adjustments have to be made to the machinery, as it will be quite impossible for the crew themselves to deal with adjustments without greater facilities than can be provided on the vessels.

It is believed that it will soon be recognised that the procedure which has always obtained with regard to opening up the machinery after the contractors' trials and the periodical opening up for inspection, should, with turbine machinery, be discontinued, as not only are so much labour and time wasted, but considerable risk occurs every time the engines are opened up. When once they have been properly adjusted there is not the same reason for examining the rotors, etc., that exists for looking at the pistons and slide valves of reciprocating engines.

The arrangement of turbines that Messrs. Parsons have thought best for smaller powers, from considerations of simplicity and lightness, is that of three shafts, *viz.*, the high-pressure turbine on one wing shaft, the intermediate-pressure turbine on another, and the low-pressure turbine, of more than one-third power, on the centre shaft. As the reversing turbine is necessarily a part of the low-pressure turbine, only one shaft is available for astern going, so that from the control and steering point of view, the vessel is practically a single-screw one. Some of the earlier turbine vessels did not have very good astern power, but in the later torpedo boats, and particularly in the 33-knot destroyers, the astern going power has been enormous, the latter vessels being capable of making upwards of 25 knots astern.

In the Italian Navy there are excellent examples of torpedo boats of 26-knots speed, fitted with twin-screw reciprocating engines, a considerable number having been built by the firms of Messrs. Pattison and Messrs. Odero, from designs supplied by the author's firm (Fig. 7). They are armed with three 18-in. deck tubes, and three 3-pounder guns. Although they are vessels of under 200 tons displacement, they are sufficiently good sea boats to withstand heavy weather. For some years all the torpedo boats for the Italian Navy have had their coal bunkers arranged so that they may be used for oil tanks when required. Coal protection to the machinery, however has been considered of such importance that liquid fuel has so far only been adopted to a limited extent.

The three deck tubes are arranged in the same way as has been adopted in the German Navy, *viz.*, one aft and two forward in front of the bridge and behind the turtle back. It will be noticed that the vessel has a straight keel of sufficient length to enable it to be docked without supporting the overhanging ends. This is a feature which is found most convenient, and has been generally adopted in modern

vessels in place of the "cambered" keel fitted to the early torpedo boats. The screws project very little below the line of keel, which is also a good feature where there is any likelihood of the vessels taking the ground. The possibility of vessels frequently taking the ground in certain navies has been considered of such importance that torpedo boats have been fitted with a false keel in order that the propellers may be protected. The heel piece which it was at one time thought desirable to fit under the propeller itself, being found worse than useless, has now been entirely abandoned. This false keel must, however, detract materially from the speed.

The particular coast and condition of service must, of course, be taken into consideration in the case of torpedo boats as well as destroyers, and it is possible that small vessels may be successful in some cases; but it is thought doubtful if, as a rule, good results will be obtained with vessels of much less than 180 tons. It is true that the latest British torpedo boats which are building are nearly 100 tons greater displacement, but they bear about the same relation to torpedo boats of other navies that the 33-knot destroyers do to destroyers of our own and other navies. While questions of cost may not be of the first importance in the British Navy, there are a number of countries at the present time contemplating the building of torpedo-boat craft where the amount to be expended on individual vessels will be one of the first considerations.

When considering the advantages of employing oil fuel for this class of vessel, its comparative high cost[1] and the difficulty in obtaining it must not be overlooked. The features that strike those who are actually working the vessels most forcibly are the absence of dirt and cinders and the saving in stokehold staff, the moving of the fuel and stoking being effected by steam pumps and pipes instead of stokers and trimmers. With coal-fired torpedo-boats it may be taken that the stokehold staff will be quite three times as great as with oil-burning boats, and while with coal-firing at full speed it is usually difficult to maintain sufficient steam in practice it is found that oil-fired boilers are blowing off, or are on the verge of doing so, and when the vessel is eased up the boilers are under such perfect control that the safety valves do not lift. The necessity of easing down gradually to avoid blowing off with coal-fired boilers is of course thoroughly appreciated.

The evaporative value of oil may be taken as one and a third times that of coal, and while 43 cubic ft. of bunker space are required to stow a ton of coal, 38 cubic ft. of space are required to stow a ton of oil, so that the equivalent amount of oil fuel can be stowed in 70 per cent. of the space required for coal.

The consideration of cost is not of the first importance in fuel for warships, but it is worthy of note that the most recent oil tank steamers have not been fitted to use oil fuel on account of the cost, although some years ago, when Sir Fortescue Flannery read a paper on the subject at the Institution, it was expected that many vessels would soon be so fitted.

It is interesting to compare the radius of action of the coal and oil-fired torpedo boats and destroyers, but it is difficult to draw any definite conclusions in view of the coal burning boats being generally fitted with reciprocating engines and the oil-fired boats with turbines.

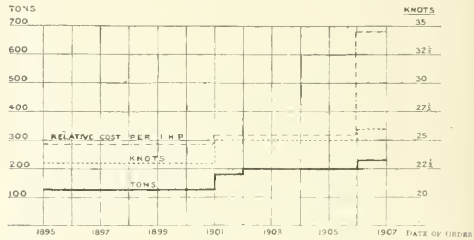
It is not proposed to go into the considerations of the relative economies of reciprocating and turbine machinery, as it is recognised that while the turbines have a very high efficiency at full power at cruising speeds, even when using the cruising turbine, their efficiency is much less than that of reciprocating engines.

In the case of the torpedo boats which have been delivered to China and Japan, it has been necessary to consider their capacity to carry coal for the voyage from Aden to Colombo and without very special arrangements it is doubtful if turbine vessels could make the voyage while Messrs. Schichau have informed the author that the vessels which they have built for the Chinese Government actually made the voyage from Port Said to Colombo without taking any coal or water at Aden, a total distance of about 3700 miles.

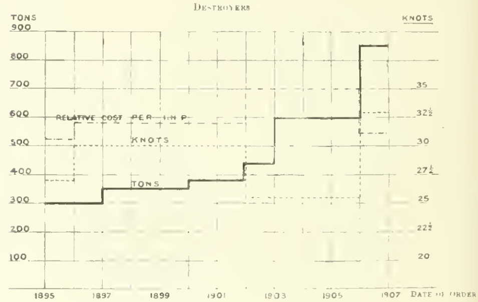
It will be noted from the diagram showing the increase in size of torpedo vessels, that in the case of the torpedo boats the tonnage, speed and price per horse-power have varied in approximately the same proportion, but as soon as the change to turbines takes place, the price per horse-power goes up very considerably. In the case of destroyers, the diagram shows that the price per horse-power also varies approximately in proportion to the increased size of boats until the introduction of the turbines in the 33-knot destroyers, when, owing to the very great power developed, the price per horse-power actually falls instead of increases.

Diagram Showing Development in Size, Speed, and Relative Cost per I.H.P.

Torpedo Boats.



Destroyers



It is admitted that to ensure freedom from breakdowns and general efficiency in service with such small vessels, every possible complication must be avoided in the machinery and mechanical devices, but with torpedo boats, like all other ships, every new class seems to require something adding to increase the complication. It is thought that the time has arrived when every effort should be made, particularly where turbine machinery is employed, to reduce the number of auxiliary engines. This suggestion will be better appreciated when it is known that in the latest turbine destroyers there are twenty-one independent steam pumps, besides fans, electric light and other engines.

An effort has been made by Messrs. Yarrow to attain this end in the destroyers building for the Brazilian Government, by fitting two very large boilers instead of four. The resulting simplification and economy in construction are, of course, great, besides a considerable saving in weight, but the advisability of using boilers in units of upwards of 4000 I.H.P. is thought to be open to question.

The policy of some naval authorities to duplicate everything, from the main feed pumps to the syrens, is thought to be a mistaken one. The reserve pumps, or whatever piece of mechanism it may be, that are in duplicate ought not to be required to be brought into operation, and in ordinary commercial engineering do not usually exist. In a battleship, which will go on fighting after receiving a great deal of punishment the conditions may be different, but the torpedo boat or destroyer either escapes or is damaged to such an extent that no duplication will save it.

It is not within the province of the author to express an opinion on the relative importance of different types of war vessels but it is hoped that the large number of destroyers and torpedo boats which are building or contemplated by the different Powers at the present time will be considered a sufficient justification for this paper.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

THE total output of new shipping from all the Scottish centres for the first four months of the year was a long way short of the figure for the corresponding period of last year, and at the time of writing there seems no prospect of the shortage being made up by the output for May, or for the next few months. The year 1908 will, therefore, very probably rank as one of "the lean years" in the annals of the Scottish shipbuilding industry. The only contracts placed during April, and during what has passed of May, were for about a dozen vessels, mostly of the smaller class, the largest not exceeding 3000 tons carrying capacity. The output of the first four months on the Clyde consisted of ninety-six vessels of 103,754 tons, as compared with ninety eight vessels of 180,146 tons last year—a decrease of two vessels and 76,392 tons. Of the vessels launched during April, one, the Pacific Steam Navigation Company's *Oronomo*, built by Messrs. Beardmore & Co., Dalmuir, was over 11,000 tons, three were between 6000 and 7000 tons, one between 4000 and 5000 tons, seven between 1000 and 2000 tons, four between 100 and 1000 tons and twenty-nine under 100 tons. Rumours of important contracts were, as usual, much abroad during April and May, but in scarcely any single case have these materialized or been confirmed. The dark labour clouds hanging over the situation render it practically impossible for builders to book new orders, and until the lock-out of wood-workers which, as every one knows, was enforced on May 4th, is ended, and a settlement of the wages question —on a basis more in keeping with the situation as regards ship-owners' requirements—is come to, no very decided improvement can be looked for in the way of fresh contracts.

Activity in Dredger Building. Steam dredgers and dredging plant usually form no unimportant part of the shipbuilding output from Clyde yards, and at present there is considerable activity in this special branch. At the launch of the sand pump dredger *Pelican* from the stocks of Messrs. William Simons & Co., Renfrew, recently, Mr. William Brown, M.I.C.E., M.I.N.A., stated that amid all the gloom that at present prevailed over the mercantile shipbuilding industry there was a cheering ray of sunshine in the fact that harbour authorities in all parts of the world had never been more active than now in increasing the area of their docks and wharfage, and in making adequate provision for ships of deep draught. The *Pelican*, at whose launch this was said, is of 850 tons gross, and has been built for the Rangoon Port Commissioners for improving the accommodation at that port. Messrs. Simons & Co. have recently shipped, to the order of the Secretary of State for India, a specially-designed hydraulic dredger 205 feet long by 40 feet beam, intended for the improvement of the waterways and for canal construction in the Bengal province. The same firm have also at present under construction two of the most powerful pump suction and reclamation dredgers ever built, also one somewhat smaller, all of which are for India. Other dredgers at present on hand are two sand pump dredgers for Colonial ports. The official dredging and other trials of the new bucket dredger *Pelusi*, built by Messrs. Lobnitz and Co., Renfrew, for the Suez Canal Co., have just been completed on the Clyde and the vessel is about to start for her destination, Port Said. She is the largest bucket dredger in the world, and for service in conjunction with her the same firm have just launched a twin-screw hopper barge of 800 tons capacity, and have others on the stocks to the order of the Suez Canal Co. The long shoot dredger, also recently launched by this firm for the Manchester Ship Canal Co., is the first of this type to be used in Britain. This dredger is now being put to work at its destination near Warrington. Messrs. Lobnitz & Co. have also just delivered to Bilbao powerful plant for submarine rock excavation which will supersede the use of explosives for rock excavation at the Bilbao port works.

Naval Work.—Scott's Shipbuilding and Engineering Co., Ltd., Greenock, who have long participated in engineering work for naval ships—one of the largest contracts executed being the machinery for the armoured cruiser *Defence*—have contracted with Sir William Arrol & Co., Dalmarnock Ironworks, for the speedy erection of extensive new shops in which the manufacture of the heaviest class of turbine machinery will be carried on. The principal shop will be 300 ft. in length and the main span in its width will be equipped with an electrically-driven overhead crane, while the equipment throughout will consist of the most modern and capable machine tools adapted for the work of turbine construction. The Scott Company are at present actively entering upon the construction of the boilers and auxiliary machinery for the battleship *St. Vincent*, being built in the Portsmouth Dockyard, the order for which they received early in the year. It should be noted, however, that although already licensed to manufacture Parsons turbine machinery, the Scott Company are not yet prepared to carry through turbines of such power—24,000 I.H.P.—and they will only make and fit the eighteen Babcock boilers and supply about fifty sets of auxiliary machinery for various purposes. The turbines themselves, it is reported, will really be constructed by the Parsons Marine Steam Turbine Co., Wallsend-on-Tyne, who, by sanction of the Admiralty, will act as sub-contractors to the Scott firm. It will be remembered that the turbines for the *Dreadnought* were constructed by the same company, under a similar arrangement with Messrs. Vickers, Sons and Maxim, the principal contractors.

Clyde-built Torpedo Boat Destroyers.—After exhaustive and successful trials on the Firth of Clyde, and even more open waters, the first-class torpedo boat "No. 17," the first of the pair of twenty-six knot vessels of the "coastal" class placed by the Government with Messrs. William Denny and Bros., Dumbarton, under the naval programme of 1906, was officially handed over to the Admiralty early in May, and she was thereafter taken to Devonport by a navigating party. She was launched from Leven shipyard on Dec. 21st last, with machinery and boilers on board, and she is the first vessel built for the British Navy by the renowned Dumbarton firm, who have hitherto confined themselves entirely to private contracts. The dimensions are:—Length, 180 ft.; breadth, 15 ft.; and depth, 11 ft. 0 in., and she, like her sister, is fitted with turbine machinery and boilers for the consumption of oil fuel. The armament of each vessel consists of two 12-pounder guns and three torpedo tubes. After the construction of the first pair was commenced in Messrs. Denny's yard orders for two more vessels of the same class were secured, and they are in a forward state of construction on the stocks. The second vessel of the lot "No. 18," was launched in April, and the series of tests in her case began in the second week in May, when gun trials were carried through on the Firth of Clyde.

New Torpedo Factory at Greenock.—The Board of Admiralty have recently supplied to the local authority of Greenock a sketch showing, in elevation, the plan of the buildings which will form the new torpedo factory to be erected at Battery Park, in the vicinity of Fort Matilda, on a site which the Board purchased sometime ago from Sir Hugh Shaw Stewart, Bart. The sketch shows a frontage to Eldon Street of two-storey buildings of neat design, which, according to official promise, in every way accords with the scenic and other aspects of the locality. The space to be occupied by the buildings is about ten acres, and in the workshops will be constructed special classes of torpedoes to meet the requirements of modern naval warfare. It is officially intimated that offers for the erection of the works will shortly be asked for from contractors, and the buildings will soon, therefore, be proceeded with. The Admiralty are in treaty with the Greenock Corporation for the supply of electricity for lighting and power to the factory, the Corporation's fine new generating station at Dellingburn Street being conveniently near. The transference of the factory from Woolwich to Greenock means adding to the population of the latter at least 700 expert workmen. After being constructed at the new factory the completed torpedoes will be tested at the new torpedo trial-range in Loch Long, on the opposite side of the Firth of Clyde.

Marine Internal Combustion Engines. Internal combustion auxiliary engines have been fitted in a large number of cruising yachts on the Clyde and in the South of England for a number of years past, and everything points to an even greater development in this direction during the next few

years. Indeed, the day of the steam engine and boiler for auxiliary power on board cruising yachts—if not on large merchant sailing vessels—would seem to be quite past, and internal combustion machinery—associated perhaps with electric plant for the purpose of lighting and heating, and for working deck appliances if not for propulsion—will be all-prevalent in the future. In this connection some attention will no doubt be attracted to a 400-ton auxiliary cruising yacht about to be launched from the yard of Messrs. John Reid & Co., Ltd., Whiteinch, in virtue of its being one of the first ocean-going vessels propelled by a combustion engine. That distinction has already been claimed for the ex-gunboat *Rattler*, fitted with gas engine and producer by Messrs. Beardmore & Co., Dalmuir, but experience with this vessel has only been of an experimental nature, and the trials have been confined to the Firth of Clyde. The new auxiliary yacht about to be launched by Messrs. Reid & Co. is to be to the order of Mr. Edgar Thornton, a South of England yachtsman, and will be the largest motor yacht afloat. When without any commission she will cruise under the burgee of the Motor Yacht Club. She is a finely modelled craft from the designs of Mr. James Reid, her rig being that of a barque with lofty spars. Her auxiliary power will consist of Gardner paraffin machinery developing something like 200 brake-horse power.

"Bon-Accord" Pumps. The new "Bon-Accord" works of Messrs. Drysdale & Co., engineers and pump makers, at Yoker have for some little time been in full operation, and the firm have at present a larger number of separate contracts on hand than they have ever before had at one time, while several of the contracts involve the machining and preparation of parts larger in size and capacity than the firm have yet dealt with. Speaking generally, the contracts on hand consist of a complete electric pumping plant, comprising two 30-in. vertical spindle electric deck pumps, and two smaller leakage pumps; three 38-in. centrifugal pumps for direct drive by Diessel engines; two large drainage pumps to be driven direct by gas engines, two complete sets of electrically-driven pumps for a floating dock, and two sets of steam-driven centrifugal pumps for a like purpose. On hand also, as a matter of course, are a number of steam-driven centrifugal pumps for marine purposes, for salvage work and for general contractors' purposes. The firm also maintain a stock of their standard types and sizes of pumps and engines to meet the sudden demands which in their experience sometimes arise.

New Form of Steam Turbine. A form of steam turbine having features of some novelty and engineering interest has been invented by Mr. John Ogg, Aberdeen, and trials were made with the first turbine of the type in the works of Messrs. W. McKinnon & Co., Aberdeen, a few days ago. The turbine in question consists mainly of a metal wheel or disc mounted on a hollow shaft, perforated with holes extending from the centre to the outside of the wheel radially. The holes are tapered from the centre outwards and form expanding nozzles for the steam or fluid which is supplied through the hollow shaft. The steam, on issuing from the nozzles, strikes against blades fixed to the rim of the wheel at an angle suitably disposed to the oncoming steam, causing the whole to revolve at a high velocity. One or more wheels may be mounted on the same shaft, and the blades of one or more wheels may be set for forward motion and others for reverse motion. In addition to the other advantages common to the turbine over reciprocating engines it is claimed that this invention is simple, cheap and occupies small space, and that its steam consumption per horse-power is economical.

Weldless Chain Making.—The process of manufacturing weldless chains as carried out by the Weldless Chains (Ltd.) Company, at Coatbridge was interestingly demonstrated to the members of the Glasgow Technical College Scientific Society on April 25th, when that body visited the works of the Company. Mr. A. G. Strathern, the managing director, explained the method of manufacture by which weldless steel chains were produced from solid steel bars of cruciform section. Several bars were heated and passed through a powerful hydraulic stamping machine, which impressed the form of the chain links on each web of the bar at the rate of fifty feet in four minutes. The machines employed in the succeeding processes were also shown in operation and tests of the finished chains were made. The Weldless Chain Co. are particularly busy at the present time, one of the recent orders being for a chain 1800 yards long to withstand a strain of eighteen tons, which will be used for haulage purposes at one of the largest collieries in the Motherwell district.

THE TYNE.

(*From our Own Correspondent.*)

The National Lock-out.—For the first time in the history of shipbuilding, a conflict between capital and labour has arisen which implicates all the shipbuilding centres in the Kingdom, and has brought the penalty of enforced idleness upon thousands of men, who were demanding nothing and were not resisting any demands, being absolutely quiescent. The Shipbuilding Employers' Federation has found it necessary to carry war into places where there was no war, and has thus in a perfectly legitimate way, justified its existence. The woodworkers of the North-East Coast, having got completely out of hand and unmanageable, it became necessary to exercise the pressure which it was in the power of the Federation to bring to bear, with the view of proving to the malcontents that, though there may be two parties to a dispute, there can only be one to win! The Federation has been much blamed for taking this drastic action; but it would have been suicidal policy to have refrained from doing so, as no institution could survive that failed to carry out the policy for which it was created. It was particularly ridiculous to hear rampant trade-unionists anathematizing the Federation for laying men idle who were not engaged in any dispute, "punishing the innocent with the guilty," as they stated. Now these trade-unionists were not only illogical, but dishonest; for no honourable adversary will deny to an opponent freedom to use the same weapons of defence as he employs himself. The employers, no doubt, deeply regret the necessity for "locking out" men who were peaceably at work; but it was an act of policy, the result of which will bring ample justification. Had the North-East Coast struggle been allowed to remain within its original limits, it would have meant irreparable damage to the trade of a wide district, and a prolongation of suffering to thousands who were in no way responsible, whereas through the promptitude shown by the employers in taking common action throughout the country, this most uncalled-for impediment to the general well-being will soon have become an unpleasant memory of the past.

The "Straight Issue."—Through the intervention of the Board of Trade, assisted by the leading lights of the labour world, the "straight issue" of saying "Yes," or "No" to the employers' original proposal for a wages reduction of 1/6 per week, is now being balloted upon by the wood-working sections of the shipbuilding industry throughout the country, and the result will have been announced some days before these lines are in print. At the time of writing, people are not sanguine of the vote being in the affirmative, but whatever the answer of the men may be, it may be assumed that the employers will, instead of allowing things to drift as hitherto, take energetic steps to carry on work in their yards—that is to say, those of them who have work—either by the aid of such old hands as may have sense enough to return to their allegiance, or by substitutes, from whatever source they can be obtained.

State of Work in the Yards.—The Low Walker yard of Messrs. Armstrong, Whitworth & Co. still holds the lead as regards the amount of work in hand, and has held this commanding position now for more than a year. The management has, of course, been greatly hampered by the strikes, but has succeeded in getting a vessel launched within the past few days through the instrumentality of the foremen, and apprentice shipwrights. The neighbouring firm, Messrs. Dobson, have four vessels on the stocks, all complete and apparently ready for launching, and there are also two or three vessels ready for leaving the stocks at the Neptune Yard, which is also in the Low Walker area. The unduly prolonged presence of these vessels on the stocks is a significant illustration of the damage done to trade by the perverseness of men who will neither work themselves, nor let others work if they can prevent them.

Messrs. Wood, Skinner & Co. have had a handsomely-designed passenger boat lying beside the yard for a much longer time than was anticipated, the hindrance to progress

in this case being the absence (through the strike) of joiners and others who were required to complete the wood fittings. This firm have two vessels on the stocks and two berths vacant; but it is believed that the latter would soon be filled if the trade disputes were ended.

The Palmer's Company.—It has been announced that the Admiralty have taken over two torpedo destroyers which this firm had recently completed, and this is the one bit of brightness in an otherwise gloomy enough prospect. The yard looks much more bare than anyone would wish to see it, considering its honourable history and undeniable pre-eminence as a shipbuilding establishment. The steel works and engine works are also very slack, and the resulting distress in Jarrow has become acute. It is to be hoped that the men on strike will soon have their eyes opened to the selfish and insane course they are now pursuing—otherwise they will eventually bring upon themselves the hardships they are now inflicting upon others.

Messrs. Swan, Hunter, & Wigham Richardson have a couple of steamers and two pontoon docks under construction in their yard; but quite half-a-dozen berths are empty. At Messrs. Stephenson's establishment, a similar state of things exists and in this case the graving dock, which, as is well known, is the largest on the North-East Coast, is for the time being unoccupied. Messrs. Hawthorn, Leslie & Co. have a vessel under repair in the graving dock; but have most of their building berths empty. The Commercial Dry Dock Company have all their existing docks in use, and have a new graving dock in a forward state of construction. The remaining yards down river show no particular change; but we note that at the Northumberland Shipbuilding Co.'s yard, one or two of the vessels under construction are at a standstill.

Messrs. Readhead are plating a vessel and are preparing to put down another, and the Smiths Dock Co., though greatly hindered by the trade disputes, are having their repairing facilities pretty fully utilised.

Engineering Work.—The North-Eastern Marine Engineering Co., Wallsend, have erected an additional large shed upon their quay, and have also made further improvements in other departments. The Slipway Co. are engining a locally-built vessel recently launched, and are carrying out extensive repairs to a large vessel in the graving dock. The St. Peters' Engine Works, do not at present show many signs of activity. The death is announced of Mr. George Robson, for many years the head of a successful engineering establishment at Tyne Dock. Manufacturers of auxiliary machinery for steamships are feeling the pinch of the times, and iron-foundries are without exception slack.

HARTLEPOOLS.

(From our Own Correspondent).

The work in the shipyards and engine works have now nearly come to a complete standstill—every department being at present paralysed through the joiners' and engineers' labour dispute. Enquiries for new work is very scarce. Messrs. Gray & Co., have booked one or two orders for cargo boats.

Herring Mule.—A launch took place at Middleton by Messrs. Cambridge Bros. (who are specialists in building a fishing craft peculiar to the north-east coast district) of a large herring "mule" and the first one to be equipped with an auxiliary mode of propulsion other than that of sails. The boat, which is 46 feet long by 13 feet beam, is fitted forward with a deck and cabin, whilst the motor is housed aft, with its necessary tanks and gear. The motor is one of Gardner's high-speed vertical petroleum engines, running at 750 revolutions per minute, estimated 16 H.P., and to drive the boat between five and six knots per hour. It has a separate circulating pump for keeping a constant flow round the cylinders. The electric ignition is by a magneto driven by gearing. The petroleum is fed under air-pressure to the burners by an apparatus that gives a constant and uniform supply. The boat has been built to the order of its owner, Mr. R. Cole, of Staithes and West Hartlepool.

THE WEAR.

(From our Own Correspondent.)

Shipbuilding.—Messrs. Short Brothers are reported to have booked some orders and are now, after a long period of slackness, likely to become busy again. This result is much to be desired, as the Pallion district in which the Yard is situated is a very populous one and for many months there has not been, by a long way, enough work "to go round." Messrs. Doxford are still well supplied; but the other yards "above bridge," have, as a rule, very little in hand. Nothing definite has yet been made known as to the probable course of events at Messrs. Laing's yard after the one vessel (an oil boat), now on the stocks, has been completed. At the time of writing, a report is current that tenders for the building of several new steamers required for special services will be asked for as soon as the strikes are settled. This may be true or it may not; but the fact that the number of laid-up boats has been largely increased lately does not tend to give confirmation to the statement. Messrs. J. L. Thompson & Sons have still some berths empty, and we confess to having little faith in any harbingers of prosperity that may be presented, until this firm's berths are filled. The two yards at the South Dock, and also the establishment at the North Dock are, without doubt, busier; and if peace were to reign again would almost certainly quickly present a still more active appearance.

Engineering. — A locally-owned steamer—the *Almond Branch*—has been placed at Messrs. Dickinson's quay to receive repairs, among which may be mentioned the fitting of six new furnaces.

Messrs. MacColl & Pollock, of the Wreath Quay Engine Works are keeping busy, having many orders in hand for engines and boilers of a small class. There is a prospect of certain local authorities coming to an understanding with a view to acting conjunctively in carrying out such improvements as may be thought necessary to make the port more attractive to shippers. The completion of the South Pier, which cannot now be very distant, will be one very effective means of doing this, for it will make of Sunderland a harbour of refuge, in addition to being a port of traffic.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

Port of Manchester Charges.—The Manchester Association of Importers and Exporters have issued a circular in which they draw attention to the fact that some of the sellers, whose premises are nearer to Manchester than to any other port, quote no lower price for delivery on boardship at the Manchester docks than for delivery at ports the transit to which necessitates a larger outlay. This custom prevents the port of Manchester, the construction and continued equipment of which have already been of great advantage to the trade of the district, from receiving the full benefit of its geographical position. The association suggests that sellers should adopt the practice of making f.o.b. Manchester their initial price, and adding thereto, when quoting alternately f.o.b. at other ports, the extra charges that would have to be paid for inland transit. A list of 120 foreign ports all over the world, to which regular lines of steamers sail regularly from Manchester, is appended to the circular.

Ship Canal Shares.—Ship Canal shares have fallen to their lowest point during the month, the quotations being in the middle of the month as follows:—Ordinary (£10), 18s. 6d.; perpetual 5 per cent. pref., 27s. 9d., 28s. 3d., 28s.

The Timber Trade.—The timber season is opening here rather quietly. Ample quantities of wood are in stock. The arrivals have been fully sufficient to meet all ordinary requirements, present or expected. On the whole prices have been easier. The imports of New Brunswick and Nova Scotia spruce and pine deals to the Mersey have been over 20 per cent. less during the past nine months than during the corresponding months of 1906-7.

Labour Trouble on the Ship Canal. — There was some trouble at the beginning of the month between the coal heavers employed at the tips at Partington and Cadishead and the Ship Canal Co. The men struck work on the ground that their guarantee of £1 a week was not being continued. The Ship Canal Co. had discontinued the guarantee on the ground that it had never been intended to be permanent, but only of a temporary character. Their desire was to put the men on equal terms with the other dockers, *viz.*, 6d. per hour during the daytime and 7½d. per hour for night work, with a guarantee that if they work at all, even for only half an hour per day, they shall be paid for four hours' work, or 12/-. per week. They are also expected to be in attendance at the tips at 7 a.m., 1 p.m., and 6 p.m. to see if their services are required. The men were left to accept these terms or seek work elsewhere.

Sailing List.—Manchester has its own official sailing list and shipping guide, which is issued monthly. The number for May came out in a better form than previously. There are three revised maps showing respectively the Manchester Docks, the entire canal and the network of barge canals and inland navigations within eighty miles of Manchester, which are in physical connection with the Bridgewater and Ship Canals. The latest estimates of population and area affected by the Manchester Ship Canal are given. The population, within an area of fourteen miles, is put down at 2,361,000.

Insanitary Ships.—During April, 225 vessels navigating the Manchester Suip Canal were inspected by the medical officer of health by the Port Sanitary Authority; insanitary conditions were found on ninety of them. Twenty-two tons four cwt. of foodstuffs were condemned, which included 212 bags of onions.

Manchester Exports to America.—During April the exports from the Manchester consular district to America showed a reduction of nearly half compared with the exports in April, 1907. The total value was £148,780 7s. 6d.; in April, 1907, the value was £238,540 18s. 7d. The exports in both instanc consisted of cotton piece goods, yarn, thread, velvets, fustians, machinery and wool-felt blanketing.

Trafford Park.—We regret to state that owing to the falling off in those engineering trades having works in Trafford Park some 4000 men have been discharged during the last two or three months. From 150 to 200 houses are now empty. The colony is being depopulated. Much distress prevails. Many of those who linger are unable to pay their rents. Relief committees have been formed. The shareholders of "Meldrum Bros.," engineers, a few miles distant, have resolved to wind up the company voluntarily.

Textile Machinery Exports.—It is remarkable that while in cotton, raw metals and other commodities exported from this country there have latterly been contractions, textile machinery exports have gone on increasing. For April the total was £748,795 compared with £628,493 for April last year, which was about £100,000 more than in the corresponding month of 1906. Taking the whole of this class of export from Jan. 1st to April 30th, the total amounts to nearly three millions sterling as compared with less than two and a half millions during the corresponding period of 1907. There was an increase in every direction except the minor countries of Europe, China and Ceylon, Germany and Holland being particularly noteworthy. Japan, India and South America also show increases.

British Westinghouse Electric and Manufacturing Co.—The first report of this company since its reorganization—whose firm occupies a commanding position in Trafford Park, close to the Ship Canal—has just been issued, and is of a favourable character. The trading profits for 1907 amounted to £92,380 as against £7600 for the previous twelve months. After payment of interest on debentures and temporary loans, and setting aside £17,000 for certain depreciations, there remained a balance of £11,340 to be carried forward. There was a substantial increase in business last year, but so far this year there has been a falling off.

Lancashire Iron and Coal Trades.—The general conditions of these trades continue without material change from a month ago. All sections of raw and manufactured iron are steadily decreasing in value, several smelting furnaces have been closed down, and the outlook is gloomy. In coal, the export trade is in a healthy state. House coal is not so much in request, owing to the warmer weather and the prospect of a favourable summer. Engine fuel is in fair request. Cotton trade is less brisk. There are symptoms of coal becoming cheaper, in a month or two, but it is hardly likely to continue much lower in price for any length of time. A coal-washing plant to deal with 65 tons per hour is being manufactured in Manchester on the Baum system. Manchester district pit prices of coal have not changed for months. Far different has it been with iron. Latest quotations are as follows:—Pig iron: Scotch, Eglinton, 59s. 6d.; Dalmellington, 59s.; Glenganrock, 60s.; Gartsherrie, 62s. 6d., delivered Manchester Docks; 2s. 3d. less per ton if landed at Heysham or Fleetwood, and 1s. less if delivered at Preston. Middlesbrough G.M.B., 59s.; Derbyshire, 51s. 6d.; do. forge, 50s. 6d.; Staffordshire, 53s. 6d. and Lincolnshire No. 3, 52s. 6d.; do. No. 4, 52s.; do. forge, 51s.—delivered Manchester stations. Hæmatites (East Coast), f.o.t. 57s. 6d.; do. (West Coast), 58s. 6d.; English billets, £4 12s. 6d.; do., foreign, £4 7s. 6d.; to £4 10s. Manufactured iron and steel: Iron bars, £6 15s. to £7; steel rounds, £6 10s.; flats, £6 2s. 6d.; angles, £5 17s. 6d.; joists, £6; channels, £6 2s. 6d.; tees, £6 5s.; iron hoops, £7 to £7 10s.; steel do., £7 5s.; steel boiler plates, £7 12s. 6d.; do. ship plates, £6 2s. 6d. to £6 5s.

Increased Dock Accommodation at Liverpool.—The Mersey Docks and Harbour Board have agreed to a scheme for the construction of a vestibule or half-tide dock, with a rivers lock entrance, to be called the Gladstone Half-tide Dock; a lock between the existing Hornby Dock and the new half-tide dock; a branch dock to be called the Gladstone Dock No. 1, opening out of the half-tide dock immediately to the northward of the present timber storage ground, with double storey sheds on the north and south quays; a branch dock to be called the Gladstone No. 2, opening out of the half-tide dock to the northward of the Gladstone Dock No. 1, with double storey sheds on the north and south quays; and various modifications of the Hornby Dock timber storage ground at an estimated total cost of £3,225,427. The naming of the new dock is a compliment to Mr. Robert Gladstone, chairman of the Board.

THAMES.

(From our Own Correspondent.)

The Port of London Bill.—This measure has, as announced, been introduced into the House of Commons and the second reading agreed to. As engineered by the late President of the Board of Trade, it met with very general approval from all sides, which augurs well for its future. That the scheme is in no way to depend on the rates told in its favour on its introduction. Other matters touched on were those of the wharfingers and the employment of casual labour in the future and its regulations. The department which has had charge of the matter is to have power under the arrangements to supervise the future of the Port without reference to Parliament. Mr. Lloyd George, who is answerable for the measure, pointed to the fact of the value of extra facilities to be provided by deepening the river. He also named the drawbacks that exist now in the way of cheap railway and other handling, which will probably be charged under the new system. The measure now stands referred to a joint committee of both Houses. Before this body several interests are asking to be heard. Among these are the General Shipowners' Society, the Waterside Manufacturers' Association and the Short Sea Traders' Association. The wharfingers, whose stake is a large one will also be heard by counsel. It is noteworthy that under the terms of the new measure, the lighting of the river will still be left in the hands of Trinity House, and this is in favour of the port as a whole. One shipping company, the General Steam, does not appear to favour the new proposals and looks on them as retrograde, but it must be remembered the points will all be threshed out in Committee.

Shipping Reports.—The Royal Mail S.S. Company now recommend a dividend of 2 per cent. on the ordinary stock and 5 per cent. on the preference. The accounts for 1907 show a profit of £147,245, after providing for depreciation. The report is a favourable one and shows continued expansion, the tonnage having risen from 101,257 gross register to

200,077 in five years. The accounts of J. I. Thorneycroft and Co. show a profit of £27,052 for 1907. The last of the vessels built at Chiswick has been delivered. The removal of the works has created some difficulty, it is said, but this has been now got over.

Messrs. Yarrow's Works.—This yard has now closed its doors on the Thames, torpedo boat destroyers for the Greek Government being the last delivered and packing up is the order of the day with the removal to the Clyde. A year ago, it is said, the firm employed 1200 hands and paid £2,000 a week in wages, so it will be understood what a loss this is to Poplar.

The Council Steamers.—No decision appears to have been made as to a river service this summer, and as the matter therefore stands, some cost is occurring in laying up the boats and maintaining the piers, without any return whatever. This sum is given as £16,490. The action of the Council has therefore resulted in a complete deadlock, private enterprise evidently being quite fettered by the public competition which was set up.

The Channel Tunnel Scheme.—The Company of this name has held its annual meeting and is still hopeful of ultimate success. £12,000 was spent last year in promoting a Bill in Parliament. As long as there is cash in hand, we may expect to have this matter renewed from time to time with varying success. The time would seem to be a favourable one for the project, having regard to the good relations existing between the two nations.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow-in-Furness.

The Lock-out.—What has been feared for some time in the shipbuilding trade has come about, and as far as Barrow is concerned some 1300 men are idle. At the time of writing it is impossible to tell how long the lock-out may last. The ballot is just about to be taken, but there is general fear that the offer of the masters will not be accepted. The men seem to distrust the masters and fear if they do go in no more will be heard of an increase. At the time of the lock-out there were three steamers on the point of completion at Vickers. The Mexican troopship—cruiser *General Guerrero*—was out of danger practically, but the London and North-Western's express passenger steamer *Rathmore* and the Isle of Man Steam Packet Co.'s 24-knot turbine *Ben-my-Chree* were not. There was, and is, a lot of wood work to do on both these vessels, and a delay is feared, although the firm will leave no stone unturned to get them both ready. As regards the *Rathmore* the railway company have a sufficiently large staff of joiners to take her in hand and finish her, and that may be done. The *Ben-my-Chree* is not so favourably situated, being so large a vessel—her accommodation is 2500—and the number of saloons and cabins and their size very great, and although the builders rushed all available men on to the job much remains to be done yet, and the question is how is it going to be done? This vessel is wanted for this season. There have been plenty of rumours, but many of them have been silly ones. Belfast is mentioned, but then the question arises, would the men at Belfast, being members of the same union as those locked out of the federated yards, do the work? There is a doubt about it.

The Distress.—There is a great amount of distress in Barrow consequent upon the closing of the Barrow steel works entirely. Hundreds of men are walking about the streets hungry and relief works are in full swing. The unskilled labour affected by the lock-out numbers several hundreds, and many of these have been thrown on to the hands of the relief and distress committees.

Shipbuilding Prospects.—There is nothing fresh to report regarding orders for Barrow, although rumour has it that this district will not be short of work for some time to come. It is said that some foreign orders may come, but there is nothing on which to hang the rumour at present. It is known that the firm are in touch with more than one power, but money is very tight now and consequently orders are not quick in coming. Within this year there may be a surprise or two for the shipbuilding world, but at present it is wise to confine oneself to such an expression than mention certain powers who are said to be contemplating the placing of orders for some big vessels.

Submarines.—There has been a development in the submarine building department of a very important character. All the "C" class for the British Admiralty have been launched, and the C16 is now fitting out in the dock and will leave at the end of the month. There is the A13 which has been undergoing alterations to engines. She has now heavy oil engines on her which are said to give better results. There are five submarines fitting out at the quay. One, which was launched on May 16th, is something entirely new, and may mark a new era in submarine construction. This vessel is the first of a new class, new in every sense of the word. It is larger in every way, will have more power and, if successful in the trials which it will undergo when complete, will be the beginning of a powerful fleet of submergeable craft which will have no equal in the world. Hitherto the British submarine has been cylindrical, tapering practically to a point at each end, with a sort of structure on the top to give the craft a little freeboard when on the surface. In the centre on top there has been a tower. The accommodation in this class of boat has been very meagre indeed, in fact there has hardly been standing room. This has been caused by the trimming tanks and the oil or spirit storage. The new submarine, the "D1," is really three submarines. The centre structure is the submarine really, and when afloat will show a level top. There are several top structures, but it is impossible to describe them. Attached to each side is another structure, cylindrical in shape and tapering to a point fore and aft. When she passed under the high-level bridge she appeared to be three submarines, the larger in the middle. The two attached structures are about half the length of the main structure, and it is understood that these will be used as trimming tanks and may also possibly be used for storing the oil or spirit. This vessel will be twin-screw and will have more than one torpedo tube. It is said that she will have four torpedo tubes, two forward and two aft, but one cannot say for certain. It is a strange-looking vessel anyway. Yet somehow it looks business-like and in its dull grey, almost uncanny. She is more of an experiment than anything else. No vessel has ever been so secretly guarded in its construction. All the workmen were sworn to secrecy, and she lies at present on a gridiron with high barricades on all four sides. She is to be ready soon, and her trials will be watched with no small amount of interest by the builders and the Admiralty. Mrs. Phillip Watts, wife of Sir Phillip Watts, performed the launching ceremony, and there were also present the heads of Vickers' firm and several officers of H.M.S. *Mercury*.

H.M.S. "Vanguard."—The H.M.S. *Vanguard* is growing on the stocks most rapidly. There will not be less than 1500 to 2000 tons on now. Of course, soon the shipwrights will be needed, and if the lock-out still continues there will be a delay. The joiners can be done without for several months, but that is not the case with the shipwrights. It is understood that the two tripod masts well not be in the centre line, but will be placed on opposite sides. This is a decision arrived at just lately. The machinery is in a forward state, and there will be no delay caused by the engineering department.

The "St. Paulo."—Work on the Brazilian Dreadnought proceeds slowly, and the English Dreadnought is slowly creeping up to it. There is no doubt that the Britisher will be ready and launched first.

The "Ben-my-Chree."—The turbine 24-knotter has during the month grown considerably. The boilers are now in and the two huge funnels placed in position. The turbines are in course of fitting. This vessel presents a very bold appearance, with her giant funnels and long shelter promenade deck. Work is being hurried on on her, but of course the lock-out is bound to cause delay. It is said that the *Ben-my-Chree* is as big a vessel as the Isle of Man Steam Packet Co. will be able to use, owing to the pier facilities at Douglas, Isle of Man.

The "Rathmore."—The London and North-Western express steamer *Rathmore* is almost ready, and on May 20th her engines were given a turn in the dock, and gave every satisfaction. The engines of this vessel are of as high a class as it is possible to obtain. There is a minimum of vibration.

They are balanced and on the four-crank system. Something remains to be done at the cabins of this vessel yet.

The "General Guerrero."—The Mexican transport cruiser *General Guerrero* is complete and has been put on the pontoon to be painted. She will leave Barrow in a few days for her trials.

Floating Dock.—It has been erroneously stated that the floating dock on the Clark & Standfield's system now being built is for the British Admiralty for submarines. The dock is being built to the order of Whitehead's of torpedo fame, and when complete will be towed to Fiume, the head-quarters of that firm. The error has arisen through the talk of the British Admiralty requiring floating docks for the submergeable boats. These docks have been suggested, but the Admiralty seem to hesitate about placing the order. Perhaps it is a question of expense.

The New Wharf.—The new fitting-out wharf, which will be first used for the *Vanguard*, is now nearing completion. The dredging which was undertaken by the British Dredging Co.'s new powerful dredger *Premier*, built on the Clyde, has been finished. The electric cantilever crane, capable of lifting 150 tons, is now being finished, and it only needs the sheds to be built. This wharf will be of inestimable value and vessels with a breadth up to 100 ft. can be accommodated there. The widening of the Buccleuch Dock Bridge will allow of this. The well-known contractors, Sir John Aird and Co., have the work in hand, while Handysides, of Derby, are building the bridge.

The Fleetwood Service.—The Furness Railway Co. have bought the General Steam Navigation Co.'s of London, steamer *Philomel* for their Barrow and Fleetwood service. This was rendered necessary by the sale of the *Lady Margaret* to the Admiralty. The *Philomel*, under natural draught, does 14 knots and carries close upon 1000 passengers. It is intended to use her only for a season or two.

Hæmatite.—The hæmatite iron trade is in a very low state, and hardly any business is doing. The Barrow steel works are closed and will not re-open for months, it is feared. Mixed numbers are quoted at 62s. per ton net f.o.b., while warrant are at 61s. 6d. per ton net cash. Steel orders are very scarce.

Shipping.—Shipping is dull. The total shipments of iron and steel for this year is no less than 143,000 tons behind the aggregate for the same period of 1907.

SOUTHAMPTON.

(From our Own Correspondent.)

Collisions.—On the afternoon of Saturday, April 25th last, during a severe blizzard, a collision occurred opposite Yarmouth, Isle of Wight, between the American liner *St. Paul*, outward bound from this port, and H.M.S. *Gladiator*, which was on passage from Portland to Portsmouth. The *Gladiator* was struck amidships on the starboard beam and sank almost immediately, taking about thirty of the crew down with her. The *St. Paul* returned to Southampton and was docked in the Trafalgar Dry Dock for survey. The damage above the water line was comparatively slight, but as the water was lowered in the dock the full extent of the damage became apparent. The stem of the vessel was sheared through and one of the protective deck plates of the *Gladiator* had cut a deep gash parallel to the water line and remained wedged in the opening. In the port side of the *St. Paul* a bulkhead plate from the *Gladiator* was firmly fixed and, judging by the marks on the upper plating, the *St. Paul* must have penetrated nearly half-way through the *Gladiator*, as marks are visible as far as 27 ft. aft of the stem. The following particulars of the two vessels may be of interest. The *St. Paul* was built by Cramps, of Philadelphia, in 1895, and has a gross tonnage of 11,629 tons and a displacement of 16,000 tons. The *Gladiator* is a second-class cruiser of 5750 tons displacement, and was launched at Portsmouth in 1896. Her dimensions are as follows:—Length, 320 ft.; beam, 57½ ft., and draught 21 ft. Messrs. Harland & Wolff are making rapid progress with the repairs on the *St. Paul*, and the vessel will take up her place in the sailing list for June, and will thus be in a position to take her share in the anticipated *rush* in the trans-Atlantic passenger traffic. The Liverpool Salvage Association are busy salving the *Gladiator* and removing the various fittings, etc.

On the morning of Friday, the 4th May last, a collision occurred off Portland, the vessels concerned being the British India Company's *Matiana*—5264 tons—outward bound from London to Colombo and Calcutta, and the Hamburg-American liner *Brazilia*, 6705 tons, which was homeward bound from Colombo to Hamburg. The *Brazilia* proceeded but the damage to the *Matiana* necessitated taking her into Portland, where she was temporarily repaired, after which she came on to Southampton, where she arrived shortly after noon on Saturday, the 9th May. The vessel had a cargo of 4000 or 5000 tons and after discharging the work of repairing was proceeded with by Messrs. Harland & Wolff.

The R.M.S.P. "Asturias."—This fine vessel arrived in the dock early on Monday, the 11th May, after being in dry dock at Tilbury. On Thursday, the 14th, the vessel was thrown open to the public (for the benefit of the local charities), but owing to the inclement weather comparatively few people visited the vessel. The *Asturias* is 535 ft. long and has a beam of 62 ft. 4 in., and a gross tonnage of 12,000 tons. The vessel sailed on her maiden voyage to the River Plate on Friday, the 15th May, taking a large number of passengers and a full cargo. We understand that for some time past all the berths have been booked for the return voyage. This makes the fifth vessel of the "A Class" on the South American service.

Messrs. Day, Summers & Co. have acquired the workshops of the late Southampton Docks Engineering Co., situated near berths 38 and 39 on the dock extension, where they have every facility for carrying out all kinds of repairs. The whole of the machine tools are electrically driven. Messrs. Day, Summers & Co. already had a large workshop on the docks near the Empress Dock, and the tools here are also electrically driven.

HULL.

(From our Own Correspondent.)

General Trade Report.—Since my last notes appeared, the trade of the port generally has shown considerable improvement, and now that the Baltic is practically open to navigation, freights show an upward tendency. There is also a great improvement in work generally. This is particularly the case on the docks, plenty of tonnage having arrived during the past week or two for coal cargoes, and a large number of steamers have also arrived from South American ports to discharge grain cargoes. It may be interesting to record that there have been three large steamers belonging to the Kosmos Company, Hamburg, recently discharging at Hull, *viz.*, the *Istria*, *Acilia* and *Sakkarah*, so that our German friends apparently find cargoes for their steamers to be brought to this fine distributing centre. In spite of the increased coal shipments, the various docks and railways here have been able to deal with the traffic expeditiously, and consequently steamers have received quick despatch in loading coal.

Earle's Shipbuilding and Engineering Company, Limited, Hull, we understand, have obtained an order to build a cargo steamer for a local firm of shipowners. They have in hand several sets of machinery for vessels under construction elsewhere, and have also been favoured with an order to supply new boilers for a passenger steamer belonging to one of the principal railway companies, they have likewise several vessels under repair.

Messrs. Amos & Smith have received several orders for new machinery for a vessel now building, and they also have many enquiries for new machinery; they also are fairly well employed with repair work.

Messrs. Cooper & Co. are well employed in the repairing work and also have large orders in for their special designed propeller.

The Hull Central Dry Dock and Engineering Works are full up with repair work, and are working night and day to give despatch.

BELFAST.

(From our Own Correspondent.)

State of Trade.—There is little or nothing new to report with regard to the condition of the shipbuilding trade on the Lagan; but, though things are by no means so brisk as could be desired, local shipbuilders are evidently optimistic as to

the future, as may be gathered from the fact that an enormous amount of money is being expended in extensions and improvements.

Messrs. Harland & Wolff.—The foregoing reference to developments applies more particularly to the Queen's Island firm, who are, and have for some time past, been engaged in very extensive operations dealing with increased facilities for the rapid construction and fitting-out of vessels of the largest class. Amongst these may be mentioned the vast system of overhead cranes which is being erected over the building berths in the north end of the yard, and the 150 tons floating crane, the erection of which is being pushed forward rapidly. Then, two of these north end slips are being lengthened to such an extent as will provide for the laying down of keels of vessels eclipsing in size anything at present afloat. In this connection, attention may be called to the fact that these berths not being available for building purposes accounts for the considerable decrease in the amount of tonnage now under construction from that dealt with when, as is usually the case, the yard is occupied to its full capacity.

On 16th May, the steamer *Mercian*, built by Messrs. Harland & Wolff for the Leyland line, had a successful trial in the Lough, subsequently proceeding to Liverpool. The *Mercian* is a vessel of 6,300 gross tonnage, and is 413 feet long. She is the third of three sister-ships built at the Queen's Island for the same owners, and was fitted out in twenty-five working days after the launch. The big new Holland-American liner *Rotterdam* is nearing completion, and it is intended to have her ready for sea the first week in June. The fitting-out of the Aberdeen liner *Pericles* was finished some weeks since, and her trial trip will also take place at the beginning of June. At the north end of the yard a Red Star liner named *Lapland* is nearing the launching stage.

Messrs. Workman, Clark & Co. have a fair amount of work in hand in both of their yards, though there are one or two vacant slips. On 20th May, they launched the fruit-carrying steamer *Parismina* thus adding to the long list of vessels of this class turned out by them within recent years. The *Parismina* is the seventh steamer built by them for the United Fruit Company, of Boston, Mass. Her length is 393 feet, and gross tonnage 5,000, with capacity for 65,000 bunches of bananas. Another steamer named *Heredia*, for the same owners, will be launched from the south yard shortly, while the *Cartago*, also for this Company, is at the fitting-out wharf. The Italian liner *Verona*, built by Messrs. Workman, Clark & Co., is at time of writing in graving dock, receiving finishing touches prior to proceeding on her trial trip. The *Verona* is a sister ship of the *Ancona*, recently constructed by this firm for the same owners, the Steam Navigation Company, Italia, of Genoa.

Harbour Items.—The Harbour Commissioners are having measured mile posts erected on Islandmagee, Co. Antrim, the existing mile on the County Down side of the Lough not being satisfactory, owing to the fact that the water is somewhat shallow and that fairly strong tides have at times to be reckoned with. The construction of the Queen's Road electric tramway is progressing rapidly, and it is expected that the service will be in operation in July. Good progress is also being made at the new graving dock.

Larne Shipbuilding Company. — On 20th May, this firm launched from the Olderfleet Shipyard a steel steam drifter, which they have built to the order of Messrs. J. M. Hay & Co., of Peterhead, Glasgow. The vessel is 95 feet long by 18 feet 6 inches by 9 feet 10 inches. The machinery will be supplied by Messrs. Allan Anderson & Co., of Glasgow, and a speed of ten knots has been guaranteed.

Dublin.—The Dublin Dockyard Co. launched on 16th May a twin-screw fishery cruiser, built to the order of the Department of Agriculture and Technical Instruction. The new vessel, which is named *Helga*, has been designed by Mr. James Maxton, of Belfast, adviser to the department, and is to replace a vessel of the same name, which has been sold to the Turkish Government. The new cruiser is 155 feet long by 24 feet 6 inches beam, by 13 feet 3 inches deep, and is divided into twelve watertight compartments. The machinery, which will be supplied and fitted on board by Messrs. David Rowan & Co., of Glasgow, consists of two sets of triple expansion engines, steam being supplied by a large boiler fitted with Howden's forced draught system.

JUNIOR ENGINEERS.

XX.*

Milling Machines.

OF all the machine tools in present use the milling machine has probably been the most developed within recent years. The reasons for this are many, chiefly, however, because the functions of which it is capable cover such a wide range, and a large portion of the work otherwise special to one type of machine can be performed by milling cutters.

As regards the machining of flat surfaces, where a fine surface is a desideratum and no special accuracy is required, the miller frequently takes the place of the planing or slotting machine, and especially where a single cut is all that is required the time occupied is less, as there is no idle stroke and no changing of tools. This is particularly the case with such polished parts about an engine as levers and small gear and also large nuts, the latter being arranged several on a mandrel with a pair of cutters so that two flats are simultaneously machined, the mandrel being turned successively through an angle of thirty degrees at the end of the cut for the other two pairs of sides of the hexagon.

The principal objection is that both the first cost and upkeep of the cutters is largely in excess of that of the plain cutting tool, more time is occupied in changing the tool, where a variety of cutters is necessary, and when the cutting section has been ground away by repeated sharpening the machining of the mill is much more serious than the forging of the planer tool For this latter reason the cutters are frequently used on the machine long after their best cutting speeds have had to be reduced owing to the dulled edge.

These objections, however, only become pronounced when the wear and tear is heavy; for light and intricate work the miller holds the advantage, the cutters can be formed to any desired shape, or gangs of cutters can be placed on one spindle to machine to any contour, and internal cutting in recesses can be effected by this means which would be otherwise impracticable. By suitable attachments on the machine table, such as mandrels and centres with change gear wheels, operations can be performed equal to lathe work, spirals and worms, bevel and spur wheels, the variety being almost unlimited.

For long plain milling cutters the teeth were formerly straight longitudinally, a spiral form was then adopted, the general practice now being to form the teeth as spirals having a pitch several times the length of the mill, and to cut notches at intervals along the edges so that the cuttings will clear themselves and the lubricant have free access to the surface being removed.

For disc cutters, of from ¼ in. to 1 in. breadth, the teeth are still made with an acute cutting angle, both face and sides, and with a small pitch; these cutters are, however, not suitable for heavy working and are difficult to maintain in an efficient state, the teeth are easily broken, with a considerable reduction in cutting effect. A stronger type is produced by having fewer teeth in the periphery, with a much larger section, the cutting edge being on the face alone and having a larger angle; the face is almost normal to the periphery, the edge being slightly accentuated by the clearance given to the back of the tooth. Each tooth is sharpened by simply passing the emery wheel across the face, automatic grinders being employed so that the wheel is given a to-and-fro motion across the face of the tooth, while at each oscillation the cutter is rotated so as to bring the following tooth into position for the succeeding cut of the wheel. A much slower cutting speed is necessary with these mills, but the upkeep and wear is very much less than with the other type, and with specially formed shapes the high cost necessitates a tool possessing considerable endurance. With the introduction of high-speed steels an innovation has been adopted in large cutters, the body of the mill being made of ordinary grade material, the teeth are separately formed from the more costly article and inserted into slots cut in the cylindrical part, and held in by wedging and small screws.

Plain milling machines are made both with horizontal and vertical spindles, the horizontal type somewhat resembles the planer, with the exception of the quick oscillating table,

* For Articles I. to XIX., see previous issues.

this motion being purely a positive feed in one direction, with either hand or power return when the cut is finished and the job replaced by another. In the larger models the spindle is erected upon two vertical standards, one on either side of the table, and rotated by gearing and belt drive. The cutter is bored to fit easily upon the spindle, to which it is secured by a feather key and held rigid by washers and a nut. The spindle or arbor extends the full width of the table, so that gangs of cutters can be arranged for if necessary.

The feed motion is obtained by gearing, the movement of the table being in the opposite direction to the rotation of the arbor; as usually the size of cutters employed on the plain miller do not vary greatly, the drive and feed gear is comparatively simple, the material machined being the governing factor, a cone pulley and a few change gears providing for all requirements.

Frequently the horizontal type is so constructed that a vertical spindle can be used for machining the side faces of large work, but generally a separate machine is employed, the principal difference being, of course, that the arbor is placed vertically to the table and is capable of being raised or lowered to suit variations in height. With this tool a considerable portion of what would otherwise be slotted work is performed, the ports in slide valve faces and piston valve chambers are cut out in this manner, and by means of reamer mills boring operations can similarly be conducted, such as keyways for round nose feathers in shafting.

Although the plain models have been considerably modified in design it is in the universal type that so many refinements have been effected, these machines being usually of smaller size for the general run of work. As with the plain millers the one machine is often made convertible from horizontal to vertical, a cylindrical bar in the former case acts as a support for the spindle end, and when the vertical arbor is required an attachment is fitted to this beam and, by means of internal gearing, is operated by the horizontal spindle. The time occupied in effecting the change, however, warrants the installation of two separate machines, provided a sufficiency of work is at hand to maintain them. The intricate design and construction of these modern tools is such that a fuller discussion of their salient features and advantages may be well held over for further consideration.

PARAGRAPHS.

DOLLAR ACADEMY.—Sir David Gill, president of the British Association, presided at the annual dinner of the London branch of the Dollar Academy Club held on April 25th in the Café Monica. After the loyal toasts the hon. secretary, Mr. John Knox, submitted his report on the progress of the club and its doings during the year. The chairman, in proposing the toast of continued prosperity to the Academy, gave some interesting reminiscences of his own while at Dollar, some humorous, some grave, but all evidently arousing slumbering echoes within the memories of his hearers. The point on which most emphasis was laid and which was highly appreciated by the audience, was the thoroughness of the teaching of mathematics and chemistry by Dr. Lindsay, to whose memory a high tribute was paid. Sir David referred to, and eulogised his method of teaching, which aimed at drawing out and developing what was in the pupil, giving him an interest in his studies, inducing thought and gradually leading him to work out problems, rather than stuffing him with facts before he was able to appreciate their meaning or intention. Mr. Dougall, the present Rector of the Academy, responded, and gave several interesting details regarding the school and its traditions. "Literature, science and art" were proposed in a charming speech by Dr. Alex. Morison, and responded to by Dr. Mercier, Dr. L. Guthrie, and Mr. E. Blair Leighton in terms full of wit and humour. "The Guests" proposed by Mr. John Wilson, and "The Chairman" by Mr. David Mair were duly responded to and the proceedings closed with "Auld Lang Syne." The records of Dollar Academy contain the names of many who have done well in their day and generation, and among the most prominent of those who have come to the front during recent years may be mentioned the last two presidents of the British Association, Sir Jas. Dewar and Sir David Gill, who by a singular coincidence have succeeded one another in the presidential chair. Situated at the foot of the Ochil Hills, on the north bank of the river Devon, Dollar is an ideal place for a healthy public school, with ample grounds for outdoor sports. The academy building was erected in 1818 as the result of a large legacy left by John McNabb, who, born of humble parents in the parish in 1732, went abroad and prospered. He died in 1802, leaving a considerable fortune, about half of which he left for the good of his native parish. The building is of Grecian architecture with good class-rooms and laboratories (chemical and physical). There are also technical workshops, gymnasium and lecture hall containing all the necessary modern equipments, a library, and museum. There is a cadet corps attached to the school, the uniform being after the style of the Argyle and Sutherland Highlanders. The debating club, athletic, football, cricket, golf clubs for the boys, and the literary society, hockey, tennis and golf clubs for the girls, all show indications of prospering. The places taken by pupils at the Universities and in the competitions for bursaries during last year show that the educational standard keeps a good forward position. In the last session of Cooper's Hill College we note that a Dollar pupil, Alan Izat, took first place, and was given a commission in the Royal Engineers. He obtained a special foundation scholarship with first prizes in surveying, engineering, drawing, applied mechanics, mathematics and physical laboratory. Appointments were also obtained by three pupils in the Indian public service last year. A good deal of pioneer work has been done in India in connection with the railways and public works by former pupils specially trained for such service.

THE OLD-AGE PENSION SCHEME, as presented to Parliament, appears somewhat lacking in respect to the line of demarcation which shuts out those who should have some consideration shown to them. If we are to have a pension scheme it ought to embrace the most deserving persons, as well as those who are only less so—the thrifty and the thriftless; cases have come under our notice which appeal to us as deserving of assistance by an amount representing the difference between bare necessity and that condition in which we would wish to see the aged and infirm, who have well served their day and generation, placed in the evening of life. Ten shillings per week is sufficient, on the average, to keep the wolf from the door, but to those whose circumstances in life have been above the average, it is hardly enough to reach the stage above penury, to those indeed, to whom the small luxuries of the poor have been as necessities during their working days, when they have been able to maintain themselves and also lay aside a small amount to fall back upon in later years. It would seem that in place of laying down a line within the limits of which a pension shall alone be granted, the line should be drawn to embrace a gross minimum, including all sources of supply, such minimum to be determined by competent authorities. To those who have by the exercise of care and frugality made a small provision for old age and whose weekly income reaches ten shillings, a slight addition seems a worthy crown to place upon the result of their thrift. They are as deserving of such consideration, and are in as much need of it, as those whose income from all sources, being slightly less, would participate in a pension scheme allowance on the ten shillings a week basis, thus giving them a gross income per week in excess of the other.

THE STEAM WHISTLE and its connections have been receiving more attention since the regulations as to signalling by whistle blasts were introduced, requiring sharp, clear blows without the necessity of two or three pulls at the operating valve to carry away the water of condensation. To meet the requirements, improvements have been made in the run of the pipes from the boilers and automatic drain connections fitted. In addition to other appliances we have previously noted, our attention has been directed to one introduced by Messrs. Lester & Perkins, engineers and shipwrights, which is described as the cheapest and most easily fitted drain in the market, while it ensures a clean, dry blast at any moment. In the notice of this appliance it is pointed out that all seamen must appreciate the value of a clear blast, of the correct duration for signalling in foggy weather, or close waters, where the second or third short blasts are in many cases completely stopped by a rush of water, even if the first one gets through, or the long blast is similarly choked immediately the sound issues, thus turning it into a short blast. In these cases the signal records the reverse of what is intended.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Oratios Couppas.—On April 29th, Messrs. Craig, Taylor and Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely-modelled single-deck steel screw steamer to the three-deck rule, of the following dimensions, *viz.*: 356 ft. by 47 ft. by 23 ft. 7 in. moulded. She is built of steel to the highest class in Lloyd's Registry, under special survey, and has poop, topgallant forecastle, and long bridge extending over half the length amidships. Ample water ballast is provided for in double bottom fore and aft and in peaks. She is equipped with patent steam windlass, with quick-warping ends, steam-steering gear, six steam winches, large multitubular donkey boiler, telescopic masts to the Manchester Ship Canal requirements, with derricks and derrick posts, and all the latest improvements to facilitate the rapid loading and discharging of cargo. The accommodation for captain and officers is neatly fitted up in large deck-house amidships, the engineers being in deck-houses alongside engine casing, and the crew in the forecastle. Her engines have been constructed by Messrs. Blair & Co., Ltd., Stockton-on-Tees, the cylinders being $23\frac{1}{2}$ in., 39 in., 64 in. by 42 in., with two large steel boilers working at 180 lbs. pressure. The vessel has been built to the order of Nicolas Couppa, Esq., Marseilles, under the superintendence of Mr. William Law, of Liverpool, and Mr. George Coundouris, of Cephalonia. As she left the ways, she was gracefully christened *Oratios Couppas* by Mrs. A. H. Atkinson, of "Redlands," Eaglescliffe. This is the third vessel which Messrs. Craig, Taylor & Co., Ltd., have built for the same owner.

Para and **Manaos.**—On May 2nd, two barges 65 ft. by 18 ft. by 6 ft., *Para* and *Manaos*, built to the order of Messrs. Wilson, Sons & Co., Ltd., were launched from the yard of Messrs. E. Finch & Co., Ltd., Chepstow; these barges will be sailed out to their destination, Pernambuco, and have been rigged for that purpose.

Vivo.—On May 2nd, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 130 ft. B.P. by 23 ft. by 12 ft. 3 in. by 13 ft. moulded. The vessel has been built to the order of Messrs. Moodys and Kelly, Fleetwood, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways, she was gracefully christened *Vivo* by Mrs. Isabella Pilling, after which the company adjourned to the builder's offices, where breakfast was served, and the usual toasts given and responded to.

City of Leeds.—On May 15th, Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*: Length, 370 ft., breadth, 51 ft., depth, 26 ft. The vessel is built to the highest class in the British Corporation Registry, and has been built to the order of Messrs. W. R. Smith & Son, Cardiff, and is fitted with the builders' patent improved trunk deck. The saloon, with accommodation for captain and officers, is fitted up at the after end of trunk, and a house for engineers on trunk deck, with the crew in the topgallant forecastle. The vessel is built on the deep frame principle, the frames being of bulb angle steel, and the holds are clear of all obstructions to the stowage of cargo, there being no hold beams or wide stringers. She has capacity for about 1,300 tons of water ballast in her cellular bottom and peak tanks, and her measurement capacity is exceptionally large. Six powerful steam winches with extended ends, in conjunction with eight derrick posts arranged in pairs, with wire runners and purchase spans, form a most efficient arrangement for loading and discharging light and heavy cargoes. Steam is supplied to the deck machinery by a large horizontal multitubular boiler, 10 ft. 6 in. by 10 ft. The outfit includes stockless anchors, quick-warping steam windlass, steam-steering gear amidships, and powerful screw gear aft. The hatchways are arranged in accordance with the Factory and Workshop Act as applied to docks. The accommodation flooring throughout is of "Litosilo" patent composition in lieu of the ordinary wood soles. The engines are of the triple-expansion type, by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, of about 1,450 I.H.P. on a very full specification, with boilers 16 ft. 6 in. by 11 ft. 6 in., working at a pressure of 180 lbs. The christening ceremony was gracefully performed by Miss Dorothy Vause, of Leeds, who gave the vessel the name of *City of Leeds.*

Emily.—On May 16th, Messrs. Day, Summers & Co., Ltd., of Northam Iron Works, Southampton, launched the tug boat *Emily*, which they have designed and built to the order of the Rio de Janeiro Lighterage Co., Ltd. The christening ceremony was gracefully performed by Mrs. Mackenzie, wife of the Secretary of the Rio de Janeiro Lighterage Co., Ltd. The *Emily* is 96 tons B.M. with a length of 80 feet between perpendiculars and 16 feet beam. The engines are compound surface condensing with cylinders 15 in. and 30 in. diameter and 24 in. stroke, and the boiler is designed for a working pressure of 120 lbs. per square inch. The tug has been built to Lloyd's rules under special survey. Immediately after the launch, she was warped under the 25-ton sheers and the engines, boiler and funnel lifted in. The launch took place at 10.45 a.m. and at 12 o'clock the vessel had quite a finished appearance, all the machinery being on board and the funnel in place. This makes the ninth vessel the firm have sent out to South America.

Norfolk County.—On May 16th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter, the principal dimensions being 84 ft. B.P. by 18 ft. by 9 ft. moulded. The vessel has been built to the order of Captain W. Lucas, of Lowestoft, and will be fitted with powerful compound engines by Messrs. Crabtree & Co., Ltd., Yarmouth, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways, she was gracefully christened *Norfolk County* by Miss de Belan, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Styliani Bebis.—On May 18th, the s.s. *Styliani Bebis* was successfully launched from the shipbuilding yard of Messrs. Short Bros., Ltd., Pallion, Sunderland. She has been built to the order of Messrs. C. D. Bebis & Sons, of Pirnous, her dimensions being, length 365 ft., beam 51 ft., depth moulded 24 ft., and she is designed to carry a deadweight of 6,200 tons on a light draught. The vessel will take Lloyd's highest class and is of the single-deck type with shelter deck all fore and aft. An extra large quantity of water ballast is provided in double bottom and fore and after-peak tanks. Every arrangement that would conduce to economy has been considered in the design of the steamer, the hatches being trunked through the shelter deck to reduce cost of loading, and the winches specially constructed with extended whipping shafts and large barrels and drums in conjunction with double derricks that discharging may be rapidly and easily carried out. The saloon, neatly fitted out in oak, is situated in a large deck-house on shelter deck, along with rooms for owner and captain and two spare rooms. The officers and engineers' rooms are in deck-houses alongside engine casing and the crew are berthed in the fore end of the shelter deck. A large donkey boiler of multitubular type is fitted on the main deck, capable of maintaining a full head of steam when all auxiliary machinery is working. The propelling machinery is fitted by Messrs. George Clark, Ltd., Sunderland, and consists of engines with cylinders 25 in., $42\frac{1}{2}$ in., 69 in. diameter with a stroke of 45 in., taking steam from two powerful boilers working at 180 lbs. pressure. On leaving the ways the vessel was gracefully christened by Miss Dorothy Short, Sea View, Sunderland. During construction, the vessel and machinery have been under the supervision of Mr. H. J. Richards, of Cardiff.

LAUNCHES—Scotch.

Bellambi.—On April 30th, the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, launched a steel screw steamer for the Australian coasting trade of The Bellambi Coal Co., Ltd., of Sydney. The vessel is 244 ft. in length, and has been constructed to Lloyd's highest class under the superintendence of Mr. J. D. Morrison, of Glasgow. The vessel was named *Bellambi*, and immediately after the launch was placed in the company's dock to receive her machinery, which has also been constructed by the builders.

Pelican.—On April 30th, there was launched from the works of Wm. Simons & Co., Ltd., Renfrew, with steam up ready for work, an exceptionally large and powerful dredger, built to the order of the Rangoon Port Commissioners under the direction and superintendence of Mr. Geo. C. Buchanan, M.Inst.C.E., chairman and chief engineer to the Commissioners, and of Messrs. P. W. & C. S. Meik, M.Inst.C.E., 16, Victoria Street, London, the Commissioners' consulting engineers in England, assisted by Mr. Robert Anderson, resident inspector. As the dredger left the launching ways she was gracefully named the *Pelican* by Mrs. Buchanan, wife of the chairman of the Commissioners. Classed at Lloyd's this vessel has a teak shade deck the full length of the ship, with an awning deck of same material all fore and aft. The European and native officers are housed on shade deck in accommodation thoroughly ventilated and efficiently lighted. The native crew is accommodated under main deck forward. The sanitary arrangements are of the latest description for craft working in hot climates. Above the awning deck there is an operating house having a clear outlook in all directions. All telegraphs, gauges, handles for controlling the propelling and pumping engines, bow and stern winches and pipe hoist winch are placed in this house, thus enabling one man to control the entire mechanism of the vessel and direct all operations, whether dredging or steaming, while having the pipe line and mooring chains under observation. The pumping plant consists of very large and powerful centrifugal sand pumps of special design to give free spaces in all passages. The wearing surfaces of the pumps are protected by easily renewable liners of very hard steel. Each pump is driven by one set of triple-expansion surface condensing engines. The sand pumps and their engines are placed in one engine-room together with one large main condenser, air pumps, centrifugal circulating pumps, feed and bilge pumps, and the other usual engine-room auxiliaries. The suction pipes are of massive construction and are fitted with nozzles designed to suit the character of the material to be dredged. Very powerful water jets are fitted to underside of nozzle. The discharge pipes are led from each pump, and are united into one common discharge pipe. The coupling between the discharge pipe and the floating pipe line is designed to facilitate coupling to and from this pipe line. The floating pipe line itself is built up of sections carried on pontoons, the sections being united by couplings of special construction. The manœuvring winches fitted at bow and stern are of a very massive and powerful character, and were specially designed for meeting the action of the strong current in the Rangoon river. The suction pipes are controlled by independent steam hoisting gear. The vessel is propelled at a high rate of speed, by two sets of triple-expansion surface-condensing marine engines, each driving its own propeller. The propelling engine auxiliaries are of a most complete character, including main condenser, air pump, centrifugal circulating pump, automatic feed pump, bilge pumps, filter, evaporator etc. Steam is generated for all propelling, pumping and auxiliary machinery by high-pressure marine multitubular steel boilers of very large capacity for burning low-grade coal.

Tosca.—On May 2nd, there was launched from the Ayr yard of the Ailsa Shipbuilding Co., Ltd., the handsomely modelled steel screw steamer *Tosca*, built to the order of an Ayrshire Shipping Company. The christening ceremony was gracefully performed by Miss Bertha Pratt, Thirkleby Park, Yorkshire. The new vessel will be towed to Troon shortly to receive her machinery, which is being constructed at the engine works of the Ailsa Company.

Wacousta.—On May 6th, Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer *Wacousta*, which they have built to the order of Mr. P. A. Grön, of Sandefjord. The vessel is 352 ft. long, 46 ft. beam, 27 ft. 6 in. depth moulded, is of the single-deck type with poop and forecastle, and has clear holds with exceptionally large hatches and derricks. Large water ballast capacity is provided for in the cellular double bottom peaks and in topside tanks under the upper deck. Accommodation for captain and officers is arranged in deck house amidships, for engineers on poop deck alongside engine casing, and for the crew under poop deck aft, all being of a very superior nature. A complete installation of electric light has been fitted, also bronze propeller, while the winch outfit is exceptionally powerful. The machinery, which is placed aft, is being supplied by Messrs. John G. Kincaid & Co., Ltd., Greenock. The vessel and machinery have been built to the highest class of the Norwegian Veritas, and under the supervision of Mr. A. D. Christensen, the owner's superentendent.

Protect Me.—On April 29th, a new steam drifter named *Protect Me*, built to the order of Captain Duthie and others, was launched by Messrs. A. Hall & Co., Footdee, Aberdeen. The dimensions of the vessel are: Length 86 ft., breadth (moulded) 18 ft. 6 in., and depth (moulded) 9 ft. 9 in.

Branch.—On April 30th, there was launched at Govan by Messrs. Mackie & Thomson, Ltd., the steam herring drifter *Branch*, built to the order of Messrs. John Mitchell & Son, Peterhead. The vessel is of ninety-three tons gross. She will be fitted with engines of 200 horse-power.

Prinz Hohenlohe.—On April 30th, there was launched at Dundee by Messrs. Gourlay Bros. & Co., Ltd., the finely modelled triple-screw steamer *Prinz Hohenlohe*—a sister ship of *Baron Gautsch*—now being fitted out for the same company—to the order of the Austrian Lloyd Steam Navigation Co., Trieste. The vessel has been specially designed for passenger and mail traffic from Trieste down the Dalmatian coast, on the eastern side of the Adriatic, no cargo being carried. She is of the awning deck type, with three complete decks laid, as well as a promenade deck and boat deck above, and is constructed to the highest class in Lloyd's and in the Austrian Veritas Registries. The vessel is supplied with a Cochran (Annan) donkey boiler with patent seamless furnace. Her principal dimensions are: Length 270 ft., breadth 39 ft., depth (moulded) 18 ft., while the gross tonnage is about 2,000. The total number of passengers arranged for is 280—90 first-class passengers, 40 second-class and 150 third-class. Among those present at the launch were Mr. Robert Dussick, chief technical inspector for the Austrian Line, Captain Muller and Chevalier Falker, representing the Austrian Government, Mr. A. Davie, of the Austrian Line, Mr. R. Danneker, captain of the *Baron Gautsch*, Mr. Morrison, Lloyd's surveyor, Mr. Gordon Lyon, Mr. C. G. Gourlay and Mr. W. S. Jackson.

Desire.—On May 17th, Messrs. Herd & M'Kenzie, Findochty, launched a finely modelled fishing steamer for Messrs. Smith & Son and M'Intosh, Portessie. The steamer was named the *Desire* by Miss Smith, daughter of the skipper. The vessel left in tow the same day for Glasgow *via* Caledonian Canal, to have compound engines installed by Messrs. Gauldie, Gillespie & Co., Glasgow.

Bournemouth Queen.—On May 18th, there was launched at Troon by the Ailsa Shipbuilding Company, a paddle steamer which they have built to the order of Messrs. Hutson and Sons, engineers, Glasgow, for the Southampton, Isle of Wight, and South of England Royal Mail Steam Packet Co. The following are the dimensions of the vessel: Length, 200 ft., breadth 24 ft., and depth (moulded), 8 ft. Compound engines are being supplied by Messrs. Hutson & Sons. Accommodation is provided for a large number of passengers. A promenade deck extends from the stem to within a short distance of the stern. The vessel was named *Bournemouth Queen* by Miss Lilian White, daughter of the chairman of the Southampton Company.

Twin-screw Tug boat.—On May 19th, there was launched at Port Glasgow, by Messrs. Ferguson Brothers, with machinery fitted aboard and steam up, a powerful twin-screw tugboat for the Crown Agents for the Colonies. The contract has been carried out under the superintendence of Messrs. Coode, Son and Matthews, consulting engineers, London, and Mr. Robert Anderson, Renfrew, resident engineer. The vessel, which has been built to Lloyd's highest class, will go for her trials on the Clyde and thereafter sail for Lagos.

Dondo.—On May 20th, there was launched at Port Glasgow, by Messrs. Russell & Co., the steel screw-steamer *Dondo*, built for the Empreza Nacional de Navagacao, Lisbon. Her dimensions are: Length, 360 ft.; breadth, 49 ft. 3 in.; depth, 28 ft.; with a carrying capacity of 6,900 tons. The machinery will be supplied by Messrs. J. G. Kincaid & Co., Ltd., Greenock.

St. Combs.—On May 2nd, a new steam drifter, built to the order of Mr. Edward Gordon, fish curer, Fraserburgh, was launched by the John Duthie Torry Shipbuilding Co., Ltd., Aberdeen. The vessel, which was named *St. Combs*,

is of the following dimensions:—Length, 92 ft.; breadth, 18 ft.; and depth, 10 ft. She is to be engined by Messrs. James Abernethy & Co., Aberdeen.

Express.—On May 4th, there was launched at Rutherglen, by Messrs. William Chalmers & Co., a finely modelled screw tug for Russian owners. The tug is built for special service on the ice-bound rivers of the Far North. She will be fitted with powerful compound surface condensing engines by Mr. James Ritchie, Glenavon Engine Works, Partick. A feature of the vessel will be the salvage and fire-extinguishing plant, with special pumps of exceptional capacity. The vessel was named *Express*.

Bon Accord.—On May 5th, there was launched a trawler built to the order of the East Coast Steam Fishing Co., Ltd., by Messrs. Hall, Russell & Co., Ltd., Aberdeen. The vessel was named the *Bon Accord*. Her dimensions are:—Length, 115 ft.; breadth, 22 ft. 6 in.; and depth, 13 ft. Steel boilers and triple-expansion engines will be supplied by the builders.

Jessie Wetherly.—On May 7th, a trawler, built to the order of the Wetherly Steam Fishing Co., Ltd., Aberdeen, was launched from the shipbuilding yard of Messrs. Hall, Russell and Co., Ltd., Aberdeen. The vessel, which was named the *Jessie Wetherly*, is of the following dimensions:—Length, 115 ft.; breadth, 22 ft.; and depth, 13 ft. The boiler and triple-expansion engines will be supplied by the builders.

Mirim.—On May 9th, the stone-depositing hopper barge *Mirim*, built by Lobnitz & Co., Ltd., Renfrew, for Messrs. S. Pearson & Son, Ltd., Westminster, was successfully launched and has left for Para.

Lea Rig.—On May 13th, Mr. George Thomson, Buckie, launched a finely-modelled fishing steamer named the *Lea Rig* for Messrs. John Coull & Sons, Buckpool. Mrs. Coull, wife of one of the owners, performed the naming ceremony.

Bon Ami.—On May 14th, Mr. William Geddes, Portgordon, launched a finely modelled fishing steamer, built to the order of Messrs. William Davidson & Co., Hopeman. As the vessel left the ways she was named *Bon Ami* by a daughter of one of the owners. The vessel was taken to Portgordon Harbour prior to being towed to Aberdeen, where compound engines will be fitted by Messrs. Lewis & Son, engineers. The *Bon Ami* measures 85 ft. in length, 18 ft. 6 in. in breadth, and 9 ft. 6 in. in depth.

La Flandre.—On May 14th, the Dundee Shipbuilding Co. launched a steamer of 750 tons for Mr. E. Minne, Ghent. The vessel is named *La Flandre*, and her dimensions are as follows:—Length, 185 ft.; beam, 30 ft.; moulded depth, 10½ ft. Her engines will be constructed at Sunderland.

LAUNCH—Irish.

Cartago.—On April 30th, another important addition was made by Messrs. Workman, Clark & Co., Ltd., Belfast, to the long and interesting list of steamers specially designed and constructed by them for the banana and general fruit-carrying trade. The vessel, the sixth steamer built by the above firm for Messrs. The United Fruit Company, Boston, Mass., is the first of three steamers at present in course of construction in the above shipyards for the same owners, and it is interesting to note that she is the fourteenth vessel designed and built by Messrs. Workman, Clark & Co., Ltd., to fulfil the special requirements of this, one of the most recent and rapidly developed of modern commercial enterprises. The United Fruit Co. at present operate a fleet of about sixty steamers, but the heavy increase in the volume of business between the United States and the Tropics, together with the development of new fruit-growing centres in the West Indies, has necessitated an increase in the tonnage engaged in this trade. The *Cartago* is the first of the three large refrigerator steamers being built to cope with this increased traffic, and these, when finished, will be the largest and most completely equipped fruiters in the world, being 393 ft. in length with a gross tonnage of 5000 and a capacity of 65,000 bunches of bananas. She has been built under special survey for the highest class in the British Corporation Registry of Shipping (R.B.S.*) and fulfils the conditions demanded by the British Board of Trade and the United States Steamship Passenger Inspection Service for a first-class passenger and cargo steamer. The arrangement of the passenger accommodation has been made the subject of very careful consideration, with the special view to the comfort of the passengers in the tropical climate in which the steamers are intended to trade, and all the apartments, public and private alike, will be found to be replete with the most modern contrivances for ensuring the comfort of the passengers. Accommodation is provided for over a hundred saloon passengers in exceptionally large and well-lighted state-rooms on the upper bridge and shade decks. The state-rooms, which are 8 ft. long and 11 ft. wide, are tastefully furnished with a couple of white enamelled iron beds fitted with spiral spring mattresses, the upper berth being arranged to fold up when not in use. The settees are fully upholstered and can be used as a bed when required. All the beds have been made exceptionally long and wide. The wardrobes and double folding lavatories are in mahogany, and the walls, being enamelled white, have a cool and comfortable appearance, which will be much appreciated in the warm climate for which the vessel is intended. The main entrance hall is placed in the long house on the bridge deck, and double doors on each side of the house give access to the deck, where ample space, seven feet wide, extending the full length of the bridge deck on each side of the house, is reserved for promenading. The main state-room on the upper deck is arranged along the sides and in the centre of the vessel, being reached from the entrance hall by a broad double stairway. Opening off the forward end of the entrance hall is the dining saloon, a handsomely decorated and furnished apartment, with seating for ninety persons. This room is most effectively lighted by large rectangular windows in the front and sides, and through a well in the deck above by a brilliantly lighted stained-glass dome over the centre of the room. The lounge on the promenade deck is reached from the entrance hall by a handsome staircase, and opening off this apartment, which is well lighted by a large skylight overhead, are four suites, each comprising a large and handsomely furnished bed-sitting room with separate bath-room and closet, while a broad, central corridor leads forward to the music-room at the fore end of the house; this room, lighted by large rectangular windows in the front and sides and by the stained glass dome overhead, is most tastefully decorated and luxuriously furnished, being supplied with easy chairs, writing tables, book-cases and a grand piano by Schiedmayer. Leaving the lounge by double doors on either side of the house you reach the promenade deck, where there is abundant space for deck games or promenading under the protection of a light shade deck overhead, to which access is afforded by open stairways at the forward and after ends. On this deck are the lifeboats, one of which is of steel, which are fully equipped and ready for service in case of any emergency, additional boats and a large steam launch being placed on a boat deck over the after deck-house. At the forward end of this deck is placed the steel deck-house containing the captain's and officers' quarters and the navigating rooms, this deck being reserved for the use of the officers in charge of the vessel. On the shade deck over the house is placed a 20,000 candle-power Admiralty searchlight, arranged so as to be operated and controlled from the navigating bridge. The wireless telegraph room, on the promenade deck, is fitted up with the latest and most improved instruments for receiving and despatching messages by this mysterious method. A couple of stairways, one on each side of the deck, lead down to the bridge deck alongside of the smoking-room, at the after end of which there is fitted up a well-sheltered alcove suitably furnished with tables and comfortable chairs, affording a pleasant lounge in the open air. The smoking-room, entered from the alcove, is a handsomely decorated and furnished apartment with comfortable settees and easy chairs, the tables being provided with all the accessories usually found in a well-equipped smoking-room; adjoining this room is the all-important bar and a suitable lavatory. The windows of all the public rooms and the doors and windows of all state-rooms opening on to the decks are fitted with inner venetian shutters and doors, thus affording the maximum of ventilation necessary for comfort in the tropics, and at the same time ensuring absolute privacy. The saloon pantry, opening off the after end of the main entrance, is thus convenient to the dining saloon, and will be found to be replete with all the latest devices for ensuring a prompt and efficient service, having a hoist direct to the galley, which is arranged

on the deck below, and is fitted up with all the most up-to-date culinary appliances necessary for catering for a full complement of passengers and ship's staff in a manner suitable for a first-class passenger service. The engineers' quarters have been arranged at the after end of the bridge space convenient to the engine-room entrance, while the petty officers' rooms are placed in the forecastle. The firemen and seamen are berthed in a steel house at the after end of the upper deck, where separate mess-rooms and a galley have been provided for their use; the firemen gaining access to the scene of their duties by means of a trunkway from their quarters to the shaft tunnel and thence to the engine and boiler rooms. Very particular attention has been given to the matter of ventilating and heating all the living apartments throughout the vessel, so that they may be made comfortable in the extremes of temperature which are met with on the service in which these vessels trade. The steam-heating installation is of the most complete character, all the passengers' rooms, public, and private, officers' rooms, petty officers' rooms and crew's quarters being included in the system. An ingenious system of cooling the saloons and state-rooms has also been installed, so that the passengers may, in the hottest climate of the Tropics, enjoy the luxury of a state-room kept at as low a temperature as they may desire, the cooling apparatus as well as the heating radiators being under the control of the occupants of the several rooms. The lavatory arrangements throughout have also received very special consideration and will be found to be of the most satisfactory nature, comprising as they do both plunge and needle spray baths with hot and cold water supplies. Particular attention has been given to the ventilation of these apartments and the result is all that could be desired. These vessels are provided with tanks for stowing an exceptionally large quantity of fresh water, practically the whole of the double bottom, which extends the full length of the vessel and the forward and after peaks, in addition to four large specially constructed tanks in the holds, being arranged for this purpose. This water is pumped up through a filter to the daily-supply tank on the shade deck, from which it gravitates to the various draw-off taps throughout the accommodation. The demand for iced drinking water has received attention, a drinking fountain being provided in the main entrance hall for the supply of this luxury. The facilities for handling the cargo are of the most reliable and approved type. The cargo spaces are divided, by decks and bulkheads, into six compartments, which have been carefully insulated on the most approved methods and fitted up for the carriage of fruit cargoes in bulk. These cargoes will be kept in marketable condition during the voyage by cooled fresh air delivered by powerful electrically-driven fans through ducts to each compartment. This air is cooled by being passed through cooler rooms which are fitted up on the special system devised by the United Fruit Company, who have made a speciality of the preservation of fruit cargoes, and the success which has attended the adoption of these principles points to the fact that they have been based on sound theories. In the after 'tween decks a large space has been partitioned off and specially fitted up for the reception and preservation of the perishable stores and provisions required by the commisariat department during the voyage. The refrigerating plant in connection with the cooler rooms, stores and room-coolers consists of two horizontal duplex carbonic anhydride (CO_2) machines with the necessary compressors, evaporators and brine circulating pumps, the whole together comprising a plant of the most up-to-date character. The holds are furnished with four large hatchways, each of which is equipped with steam winches, suitable derricks and the necessary special appliances for dealing with general cargo and fruit in bulk, making it possible to handle a full cargo in the shortest possible time and with the minimum of labour. Appliances are also fitted for handling lifts of 25 tons. The vessel is lighted throughout by electricity, a most complete installation having been provided. The necessary current is supplied by four Curtis turbine-driven generating sets, three of which are capable of driving all the fans in the cooler rooms, state-room coolers, laundry and other motors, in addition to the lighting and searchlight. For her propulsion the *Cartago* relies upon a set of triple-expansion engines of 3500 I.H.P. of the latest type. The cylinders are each carried on two hollow cast-iron columns, the sole plate being also of cast iron. The condenser is built of steel plates and is independent of the framing of the engine, being carried on brackets attached to the back columns of the engine. The auxiliary machinery installation is of the most complete character. The main boilers, five in number, are of the single-ended cylindrical multitubular type, built of steel, and working at a pressure of 190 lbs. per square inch under Howden's system of forced draught. The designing and construction of the vessel and machinery have been carried out under the direction and supervision of Captain Wm. Anderson, manager of the Marine Department, and Mr. Llewellyn Williams, superintending engineer for the United Fruit Company.

TRIAL TRIPS.

Adur.—The s.s. *Adur* claims to be the smallest sea-going tug in the world and was designed by Messrs. James Pollock, Sons & Co., Ltd., and built by Messrs. Forrestt & Co., of Wyvenhoe, for the towage of large sailing yachts. Her dimensions are: Length, O.A., 42 ft. 6 in.; length, B.P., 39 ft. 3 in.; breadth (moulded), 9 ft. 6 in.; depth, 5 ft.; mean draught, 3 ft. 10 in. Her hull is of steel decked with teak and a strong though light towing gear is provided. She has two cabins finished with varnished pitch pine, containing cushioned seats, lockers, folding beds, cooking stove, etc. Her compound engines have cylinders 7 in. and 12 in. by 8 in., and a return tube boiler 5 ft. diameter by 5 ft. 6 in. long, with all necessary pumps and fittings. The feed-water tanks carry five tons. At her trial trip the *Adur* averaged a little under 7½ knots and succeeded in towing a steel barge displacing 100 tons at a speed of five miles per hour.

Taormina.—On April 27th, the large twin-screw steamer *Taormina* (of which we gave particulars in our March issue, page 347), built by Messrs. David and William Henderson and Co., Ltd., Glasgow, for Messrs. the "Italia" Societa di Navigazione a Vapore, Genoa, went down the river and ran her trials, which extended for over three days, and were in every way successful; the coal consumption trials more than realized the most sanguine anticipations of owners and builders, and, during the long full speed trials, the vessel maintained an average speed of over sixteen knots. At the trials, the owners were represented by Captain Roncallo, Naval Superintendent for the "Italia" Company, Captain Falconi, who commands the vessel, Lieut.-Col. Lauro, of the Royal Italian Navy, and Mr. Parodi, assistant superintendent engineer, all of whom expressed their satisfaction with the excellent performance of the steamer.

Cassandra.—On May 9th, the speed trials of the new twin-screw yacht *Cassandra* (of which we gave particulars in our March issue, page 348)), built for Mr. Roy A. Rainey, of New York, by Scotts' Shipbuilding and Engineering Co., Ltd., Greenock, took place, when the owner was on board. Instead of being in the usual trial condition for yachts, the vessel had over 200 tons of coal and stores on board, thus being in mean cruising trim. A mean speed of over fifteen knots per hour over twelve runs on the measured mile was attained under natural draught conditions, and of over sixteen knots between the Cloch and Cumbrae Lights under assisted draught, which represents fully a knot per hour over the requirements. The almost entire absence of any vibration was a most notable feature of the trial. The yacht is supplied with a Cochran (Annan) donkey boiler, with patent seamless furnace.

Romsdal.—On May 9th, the handsome steel screw steamer *Romsdal* was taken to sea for her trial trip. The builders are Messrs. Wm. Gray & Co., Ltd., of West Hartlepool, and her owners Messrs. J. Johanson & Co., Lysaker, Norway. She takes Lloyd's highest class and is of the following dimensions: Length over all, 342 ft.; breadth, 47 ft. 6 in.; and depth, 25 ft. She has long bridge, poop and topgallant forecastle. The saloon, state-rooms, captain's, officers' and engineers' rooms, etc., are fitted up in houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom, and large aft peak ballast tank. Six steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, and all the requirements of a first-class cargo steamer are fitted. Triple-expansion engines have been supplied by the Central Marine

Engine Works of the builders, having cylinders 24 in., 38 in. and 64 in. diameter, with a piston stroke of 42 in. Steam is generated in two large steel boilers adapted for a working pressure of 180 lbs. per square inch. Amongst those on board were Mr. and Mrs. Johan Johanson, Mrs. Von Goes, Mr. Olaf Arnesen, Chief Surveyor to the Norwegian Veritas, Sunderland, Mr. S. J. Schelderup, Surveyor to the Norwegian Veritas, Sunderland, Mr. Duncan Robertson, Chief Surveyor to Bureau Veritas, Glasgow. Captain J. E. Murrell represented the shipbuilders and Mr. Maurice S. Gibb, the engine-builders. A very successful run was made, during which the vessel attained a speed of eleven knots per hour.

Russia.—On May 12th, the twin-screw steamer *Russia*, of St. Petersburg, built and engined by Messrs. Barclay, Curle and Co., Ltd., Whiteinch, concluded a series of highly successful trials in the Firth of Clyde, attaining a speed of over seventeen knots on the measured mile. The principal dimensions of vessel are: Length, 493 ft.; breadth, 57 ft. 9 in.; depth, 35 ft. 6 in. Gross tonnage about 9,000 tons. Fitted with two sets triple-expansion engines, one single-ended and three double-ended boilers, with a working pressure of 200 lbs., fitted with Howden's forced draught. The vessel has been constructed to Lloyd's Rules and is specially fitted up with accommodation for about 100 first and second-class passengers, 300 third-class and about 1,500 emigrants. The first-class passengers are accommodated amidships in a large deckhouse on bridge deck, having internal passages to protect the passengers from the weather. A large, handsomely decorated saloon, extending the full width of the house and lighted by large square windows, is placed at the fore end of the bridge—the galley and pantry being conveniently situated alongside. The sanitary accommodation, to which special attention has been given, is fitted in a position central to all accommodation. The entrance hall abaft of the dining saloon gives access by means of a double stairway to the promenade deck, on which is fitted a combined music and smoke-room, a large airy apartment tastefully decorated and lighted by large cottage windows. A limited number of special rooms for first-class passengers are fitted at the aft end of the entrance house. The promenade deck forms a special feature, owing to the amount of space available. Above the music and smoke-room accommodation for the captain's room, officers' quarters, chart and wheel house is provided in a large house having a navigation bridge on top. The second-class dining saloon is fitted on poop deck with stairways leading to promenade deck above, accommodation being provided for about sixty passengers in two and four-berth rooms. Forward of the bridge space, a large dining-room for emigrants is fitted, the auxiliary departments of galleys, pantries, male and female hospitals being carefully arranged in suitable quarters. The third-class are fitted in four and six-berth rooms at the after end of the main deck, while the remainder of the main and the lower deck are completely fitted up for the carriage of about 1,500 emigrants. The vessel is lighted throughout with electricity and fitted with electric bells to all state-rooms and principal officers' rooms. A large and fully-equipped cool chamber is provided to secure an ample supply of fresh provisions throughout the voyage. Twenty boats are supplied and fitted with patent lowering gear. The facilities for lowering and discharging cargo are very complete, four cargo hatches of ample size being fitted with eight derricks and eight powerful winches. After the trials the vessel left to take up her situation running between Libau and New York.

Peluse.—On May 14th, the official trials of the new dredger *Peluse*, which is the largest bucket dredger in the world, were successfully completed on the Clyde. This dredger has been built by Lobnitz & Co., Ltd., Renfrew, for the Suez Canal Company, and has sailed for her destination, Port Said.

Dolaura.—On May 17th, the twin-screw steam yacht *Dolaura*, (of which we gave particulars in our April issue, page 382), built by Messrs. Fleming & Ferguson, Ltd., Paisley, for the Hon. James Dunsmuir, Lieutenant-Governor of British Columbia, completed progressive speed trials on the Firth of Clyde in a satisfactory manner. The engines, which are of the triple-expansion type, developed ample power for the speed of 14 knots. The *Dolaura* was designed by Mr. R. L. Newman, naval architect, Victoria, B.C., and has been built to Lloyd's A1 yacht class.

Vanadis.—On May 19th and following days, the steam turbine yacht *Vanadis*, built by Messrs. A. & J. Inglis, Ltd., Pointhouse, for Mr. C. K. G. Billings, of New York and Chicago, ran her official trials in presence of her owner with satisfactory results, the full speed on an extended run being 16·46 knots. The *Vanadis* is a handsome vessel of 1200 tons, and has been built to the designs of Messrs. Tams, Lemoine and Crane, of New York. The turbines have been constructed by Messrs. A. & J. Inglis under licence from the Hon. C. A. Parsons, and have worked throughout in a manner that left nothing to be desired. After the conclusion of the speed trials a coal consumption trial of twelve hours' duration was entered upon and completed, fulfilling all requirements.

Express.—On May 20th, the steam tug *Express*, built by Messrs. William Chalmers & Co., Rutherglen, and engined by Mr. James Ritchie, Glenavon Engine Works, Partick, ran her trials on the measured mile in the Gareloch with satisfactory results. The machinery worked throughout with great smoothness, and the contract speed was easily maintained.

Tintenbar.—On May 4th, the new steamer *Tintenbar*, launched by the Ardrossan Dry Dock and Shipbuilding Co. for the North Coast Steam Navigation Co., Sydney, ran trials on the Firth of Clyde. The vessel has been constructed to the special class of the British Corporation. She has a set of triple-expansion engines supplied by Messrs. Hutson and Sons, Glasgow. On trial the contract rate of speed was easily attained. There was a large party aboard during the trial trip. The Glasgow agents for the North Coast Steam Navigation Co. are Messrs. Paton & Hendry, Glasgow.

Pelican.—On May 13th, the sand pump reclamation dredger *Pelican*, constructed by Messrs. Wm. Simons & Co., Ltd., Renfrew, for the Rangoon Port Trust, completed her dredging and speed trials with most satisfactory results. On the measured mile at Skelmorlie the vessel attained a mean speed of fully ten knots, which is a knot more than the contract speed. The Pelican will not leave for Rangoon until the end of July.

SHIPBUILDING WAGES CRISES.—Although in a monthly journal it is for the most part idle to chronicle or forecast anything on the subject of wages troubles—the progress of such matters being as rapid as it is kaleidoscopic—it is due to the great dimensions which were assumed by the general question of a proposed reduction in wages paid to the "white squad," and to the incalculable and universal consequences of the men's attitude to that proposal, that at least a brief allusion should be made to the subject. The trouble referred to, which as every one knows, developed into a national lock-out of all the wood-working class in in British shipyards grew more complex as every day passed, and as every effort was put forth, not only on the part of the authorities of the parties immediately concerned in the dispute, but on that of influential outside authorities, such as the high officials of the Board of Trade, to bring the question at issue into the proper focus for a satisfactory settlement. The Clyde workmen involved, as is well known, some time ago agreed to the reduction in the wages rate, notwithstanding that that was under the rate prevailing on the North-East coast of England. Having been "locked-out" as a consequence of the action of their fellow—and more highly paid—workmen on the East Coast, there was a growing resolve amongst them to insist, not only on the North-East coast men being granted their demands, but that the action should be seized upon to secure a levelling-up in the matter of wages rates in both districts. This, of itself, was sufficient complication, but when it is considered that workmen connected with shipbuilding are in various ways affiliated with and depending on the attitude of workmen of the same class in other departments of industry, it can readily be understood that much additional complexity was imported into the problem of satisfactory solution. Conferences and balloting processes to a puzzling extent were held, and duly chronicled in the daily press; but as has been already hinted, it remains with a journal published monthly only to wait upon events rather than chronicle or forecast them. The result of a general ballot of the whole army of 100,000 voters (although less than 20,000 are directly affected), on a not too well-defined issue is an acceptance of the employers' terms, as arranged by Mr. Churchill, and work at the various shipyards on the North-East coast and elsewhere will probably be resumed on Friday, the 29th.

THE CITY (LATE LEASK'S) ENGINEERING ACADEMY, of 4/5, High Street, Aldgate, London, again record five out of the seven London successes at the April Extra Chief Examination. This makes ten successes in this particular examination since Christmas, which, together with two successful candidates for the B.T. surveyorships, one for Ceylon and one for England, is a decidedly creditable record and specially well for that Institution.

EXTRA FIRST-CLASS ENGINEERS' EXAMINATION.—At the examination held on the 14th, 15th and 16th April, the following candidates passed for Extra First-class Engineers: Mr. A Carter, Sunderland; Mr. J. W. Brackenbury, Hull; Mr. W. R. Russell, Middlesbrough; and Mr. D. Clark, Tasmania. Of these, two passed the first time of going up, one receiving tuition entirely by correspondence. They were prepared by Messrs. W. H. Thorn & Son, 5, Waterville Terrace, North Shields. One hundred and sixty-eight pupils have passed in the above grade from this establishment, which is the highest record for any school in the kingdom. At the recent Extra Chief Examinations, out of eighty-one successes from this School, forty-one were prepared by Messrs. Thorn's original system of tuition by correspondence, thirty-two of these passing the first time of going up.

BOARD OF TRADE EXAMINATIONS.

1908. Extra First Class.

May 9th—Yeaman, James .. .. Ex 1C Glasgow

NOTE—1C denotes First Class; 2C Second Class.

April 18th, 1908.

Ballantine, E. J	1C	N Shields
Bebbington, G	2C	Liverpool
Brodie, David..	1C	Liverpool
Butt, Ernest V	2C	N.Shields
Carswell, David	1C	Greenock
Colquhoun, D H.	1C	Liverpool
Dorward, A. S.	1C	Dundee
Edgar, James ..	1C	Greenock
Farrell, Jas. F.	2C	Cork
Gasking, S St C.	1C	Liverpool
Godfrey, T. B.	1C	Liverpool
Hall, John R.	1C	Liverpool
Hickingbotham, W J	1C	London
Hodgson, G W	1C	Hull
Hudson, F. A.	2C	N Shields
Hudson, John	2C	Liverpool
Jarrett, A R ..	2C	Liverpool
Jenkins, G. H.	2C	London
Kelly, Joseph F	2C	Dublin
Kerr, M. S ..	2C	Greenock
Lackie, James	2C	Dundee
Liddell, F. J. ..	1C	N.Shields
M'Alister, Alex	1C	Greenock
Mason, D. S. ..	2C	London
Miller, Alex. ..	2C	Greenock
M'Kibbin, R ..	2C	Dublin
M'Master, Robt.	2C	London
Morgan, John	2C	Greenock
Phillipson, R.D.	2C	N Shields
Sewell, Hubert	2C	Liverpool
Simmonds, J B	1C	Greenock
Stanbridge, A A.	1C	N Shields
Steen, Thos. R.	2C	London
Trigg, Albert G.	1C	N Shields
Willson, A. A	1C	Liverpool

April 25th

Adam, K. H. ..	2C	Liverpool
Appleton, Frank	1C	W Hart'l
Arundel, G E	2C	Glasgow
Bannatyne, J D	2C	Glasgow
Banner, Thomas	2C	Liverpool
Blane, H. C .	1C	Liverpool
Bradburn, J R	1C	W Hart'l
Braidwood, T	2C	Liverpool
Bruce, Herbt. J	1C	Cardiff
Campbell, J. L.	2C	Leith
Chalmers, Robt.	1C	Glasgow
Coutts, C. M'G	2C	Leith
Craik, R. O. ..	1C	N Shields
Dougan, A.St.C.	2C	Glasgow
Downes, T. S.	2C	W Hart'l
Dunn, Douglas	2C	Leith
Ellis, George P	2C	Liverpool
Ford, John W	2C	N.Shields
Fox, Joseph F.	2C	Cardiff
Galbraith, G W.	1C	Glasgow
Howie, John ..	1C	South'ton
James, Benj. D	1C	Cardiff
Lawler, A.	1C	Liverpool
Le Riche, C. J.	2C	South'ton
Leybourne, W.	1C	W. Hart'l
Liddell, H W.	1C	N.Shields
Lofthouse, H	2C	Liverpool
Lumsden, David	2C	Leith
Makey, Harold	1C	London
M'Gregor, Alex.	2C	Glasgow
M'Kenzie, Jas	2C	Glasgow
Morris, Wm. J.	2C	Cardiff
Mudie, David	1C	Leith
Nott, Evan P.	2C	Liverpool
Paxton, John ..	1C	W Hart'l
Pegg, Henry B.	2C	W. Hart'l
Ralston, Ronald	1C	London
Rawlings, R. E.	2C	W. Hart'l
Ray, William A.	1C	W Hart'l
Rose, John F.	2C	N Shields
Ross, Leo	1C	South'ton
Rutledge, Fred	2C	W Hart'l
Saunders, W H.	1C	Cardiff
Scrivener, Robt	2C	Liverpool
Sharp, D. D. ..	2C	Glasgow
Sloan, William	1C	Barrow
Smith, A H W	2C	South'ton
Stephen, G. R	2C	Leith
Stewart, W J.	1C	Liverpool
Taylor, Ed J.	1C	Cardiff
Taylor, C H.	1C	Cardiff
Tellet, George	1C	Liverpool
Tregaskiss, C H	1C	Barrow
Tzamkiran, Geo	2C	Leith
Urquhart, J. A.	1C	Glasgow
Walkinshaw, W	2C	Barrow
Wild, John T	2C	W. Hart'l
Young, Wm R.	2C	Glasgow

May 9th

Amor, Arth. W.	1C	London
Beattie, George	1C	Glasgow
Brown, Hy T.	1C	N.Shields
Brown, Lansell	1C	Liverpool
Butler, C. H. A.	1C	South'ton
Carr, James L.	2C	N.Shields
Deans, William	2C	Liverpool
Denzey, D W.	2C	Cardiff
Dick, William	1C	Glasgow
Douglas, D.C.A.	1C	Leith
Fish, John	1C	N Shields
Fitzpatrick, T F.	2C	Liverpool
Foley, John M	1C	Cardiff
Grimshaw, A.R.	2C	Belfast
Harley, James..	1C	Glasgow
Hislop, John ..	1C	Glasgow
Hughes, C. L.	2C	Cardiff
Hunt, Bert C	1C	London
Hutchison, W.	2C	Glasgow
Jasper, Alfred	1C	Liverpool
Jones, Chas L.	1C	Liverpool
Jones, Harry O.	2C	Cardiff
Kemp, Wm. D	2C	Liverpool
King, John	2C	Glasgow
Kirkwood, Wm.	1C	Belfast
Kydd, John W.	1C	Glasgow
Kydd, William	2C	Glasgow
Lawson, A M'N.	2C	Glasgow
Lyall, John	1C	Leith
Mansfield, G J	1C	Cardiff
M'Intyre, Alex.	1C	Glasgow
Montgomery, A.	1C	Belfast
Morgan, Daniel	1C	Glasgow
M'Quade, Jas.	2C	South'ton
Murray, David	2C	N.Shields
Papageorge, P.	1C	N Shields
Peebles, D F C.	1C	London
Potter, H. O. H.	2C	Cardiff
Reid, William	1C	Glasgow
Rutter, Wm. J	2C	South'ton
Sandison, T A	1C	South'ton
Sharp, Herbt B.	2C	N.Shields
Smith, Robert	1C	Cardiff
Stirling, Joseph	2C	Glasgow
Stuart, William	2C	Leith
Taylor, W C.O.	1C	London
Thorburn, Ed	2C	South'ton
Tracey, John ..	1C	Liverpool
Troughear, John	2C	Liverpool
Tupman, A W.	2C	Hull
Turnbull, W T.	2C	Glasgow
Uncles, Geo. R.	2C	Hull
Webb, Geo T.	2C	London
West, Tasman	1C	London
Whitworth, J. P	1C	N Shields
Williams, G. E.	1C	Cardiff
Williams, J G.	2C	Cardiff
Williams, James	1C	Glasgow

May 16th.

Billclough, W.	2C	N Shields
Butterworth, G.	2C	Liverpool
Chappel, W J.	2C	N.Shields
Coward, W. H.	2C	N Shields
Foulis, David..	1C	Liverpool
Grainger, G L	1C	N.Shields
Henderson, S	2C	Greenock
Hewson, D H.	1C	Liverpool
Inwood, Jos. M.	2C	London
Irving, Lawrence	1C	N.Shields
Kennedy, S A	2C	Liverpool
Kermode, R. K.	2C	Liverpool
Lambert, Fred	1C	N Shields
Lawrie, Jas B	2C	London
Macdonald, D	1C	Greenock
Macgregor, A.M.	1C	Greenock
Marshall, H H	2C	Dundee
Maxwell, J N	2C	Greenock
M'Dermott, T H	1C	Liverpool
M'Gregor, John	2C	Greenock
Morton, Jas M.	2C	London
Patterson, W.G.	1C	London
Patton, James.	2C	N.Shields
Rankin, Geo P	2C	Dundee
Scott, William	2C	N Shields
Sutherland, D.	1C	Liverpool
Terry, Wm H	2C	London
Walker, William	2C	Greenock
Will, Walter ..	2C	Dundee

May 23rd.

Alder, Ernest E.	1C	Cardiff
Barnett, T R	1C	N.Shields
Beckmann, P A.	1C	W.Hart'l
Boaden, Ed. J.	2C	South'ton
Brewin, E V...	2C	South'ton
Burnside, Robt.	1C	Glasgow
Carter, Stephen	1C	W Hart'l
Chandler, H. L.	1C	London
Clarke, Samuel	2C	Glasgow
Cleave, Thos. C.	2C	Plymouth
Colquhoun, T.	1C	Glasgow
Craigen, W F.	1C	Leith
Crofts, M. P ..	1C	London
De Ritter, Sid	2C	London
Dick, Thos C	2C	Leith
Fairhurst, W.G.	2C	Liverpool
Fitz-Gibbon, F.	1C	Liverpool
Fleisher, F. E	2C	London
Geen, Herbt. H.	1C	Cardiff
Godfray, L C.	1C	Cardiff
Gowans, John..	1C	Glasgow
Griffiths, Fredk.	2C	London
Grimwood, R. J.	1C	Leith
Hargrave, E ..	1C	Cardiff
Harris, John ..	1C	Glasgow
Higgins, R. H	1C	Liverpool
Hurdman, R. ..	2C	W. Hart'l
Hurworth, J. P.	2C	W Hart'l
Knowles, B. W.	2C	London
Laidlaw, James	2C	South'ton
Learmouth, A C	1C	Glasgow
Lennard, Aaron	1C	W Hart'l
Livingstone, G.	2C	London
Livingstone, J.	1C	Glasgow
Longair, J. C	1C	Glasgow
Lowe, Wm H	1C	Glasgow
Macalister, C.L	2C	Leith
Marley, A. S ..	1C	W. Hart'l
McMath, J. K	1C	Leith
Menzies, A F.	1C	Glasgow
Methven, Claude	2C	South'ton
Minto, Bertie ..	2C	W Hart'l
M'Kay, Samuel	1C	Barrow
Montgomery, A	2C	South'ton
Morgan, T.H C.	2C	Cardiff
Moss, Joel B. ..	1C	London
Napier, D. J ..	2C	South'ton
Nesbitt, William	2C	W. Hart'l
Newton, R. B.	2C	W. Hart'l
Perritt, Thomas	1C	South'ton
Philips, Robert	2C	Leith
Pile, George ..	2C	Cardiff
Poton, Dewar ..	1C	Glasgow
Powrie, Andrew	2C	Glasgow
Prichard, G H.	2C	Cardiff
Purvis, Hugh ..	1C	London
Riley, Geo. E.	2C	W. Hart'l
Rose, James W	2C	W Hart'l
Scott, R. R. M.	1C	N Shields
Seys, Bert	2C	Cardiff
Shaw, Sidney..	2C	N.Shields
Snowdon, Alf	2C	W. Hart'l
Stephen, W C.	2C	Liverpool
Stevenson, W C	2C	Liverpool
Stevenson, J K C.	2C	Glasgow
Sutton, Wm J.	2C	Liverpool
Symes, Reg. L	1C	London
Teasdale, James	2C	N.Shields
Tolmie, David	2C	Greenock
Wallis, Thos. S	1C	South'ton
Wares, Alex. ..	1C	Glasgow
Ward, Joseph ..	1C	Barrow
Watson, Barclay	2C	Liverpool
Wright, John M.	2C	Liverpool

The Marine Engineer
And Naval Architect.
LONDON, JULY 1, 1908.

"THE BIG SHIP."

IN the *Nineteenth Century and After*, last month, Sir William White has an article on "The Cult of the Monster Warship" and "The Policy of Goliath." The past services of Sir William White to the Royal Navy and his unquestioned professional skill and talents as a naval architect, give to him an authority on questions of naval construction possessed by only a few other men in the country. His opinions, therefore, will be received with considerate attention, and the conclusions he has arrived at receive a respectful hearing. The points he makes are three-fold: the cult of the monster warship has flourished greatly during the last three years, and has affected naval construction in all maritime countries; if this policy be followed slavishly it will involve most serious consequences; independent inquiry is therefore necessary, and is urged by many naval officers. With regard to the first point, Sir William White admits that there is weight in the argument that the policy is justified by the practically universal adoption of its main features by the responsible authorities of foreign navies. On the other hand, he points out that the supreme position occupied by the British Navy has resulted in its lead being followed generally for many years past, and that it was therefore only natural for possible rivals to rush into the construction of the new types. The consequences which may follow involve immensely increased expenditure on each unit with, he claims, a failure to provide safeguards against some of the most serious risks incidental to modern warfare. Finally, while he recognises the right of the Admiralty to select the types of warships best adapted to the requirements of the British Navy, he contends that the circumstance that many distinguished naval officers both upon the active and retired lists are adverse to a still further increase of dimensions and cost, and the arguments they have put forward supply a case for further inquiry.

The views set forth in Sir William White's article have been briefly summarised in a letter he has written to the papers. He says that those who share his views do not believe that the *Dreadnought* and her successors represent the most efficient fighting type. They are of opinion that the defensive powers of those vessels are disproportionate to their offensive powers; that the serious increases in draughts of water when fully laden impose great disabilities, and restrict their field of operations. They assert that steadiness of gun-platform is not likely to be increased in those vessels, and that they will not prove sensibly superior to their predecessors in the power of maintaining speed in rough water or fighting their guns. They believe that the development of submarine attacks renders it undesirable to pursue the policy of continuous increase in dimensions and cost of successive ships. Practically their preference is for the provision of four *King Edwards* rather than three *St. Vincents*, believing that the former would constitute a superior force and would combine greater offensive and defensive power. Sir William White admits that he lies open to the retort, "Physician, heal thyself." His own ships were attacked as monsters, and he takes full responsibility for having advised the Admiralty to build much larger battleships and cruisers than had been built previously for the Royal Navy. His personal opinion on the subject remains unaltered, but he holds that before any radical change is made there should be full proof that the balance of advantage lies that way, and that increased size and cost are justified by gains in offensive and defensive power and general fighting efficiency. He has not, however, attempted to combat the argument that to put the Admiralty on trial before a commission or committee such as he suggests would be an unprecedented measure, fraught probably with worse consequences than those he pictures. Nor does he remove the impression that history is repeating itself, and that just as his designs were vigorously attacked by his predecessor, Sir Edward Reed, so he now, being out of office, is disparaging the creations of his successor, Sir Philip Watts, in whom the confidence of the nation will not be lessened because he confines his attention to his work and is not given to rhetorical display on the platform or in the press.

PROGRESSIVE DEVELOPMENT

THERE is a natural desire on the part of all nations, when a certain stage is reached in the progressive development to which each aspires, to manufacture for themselves the goods for their own use, and at a subsequent stage, to make and erect the machinery necessary for the manufacture of these goods; a further stage is reached when the ambition is to have the goods thus placed on their own market by the fruit of their own labour, carried elsewhere for disposal, and in conveyances—whether by land or sea—built by themselves. During the last quarter of a century and especially during the last decade, the aggregation of these desires and ambitions has caused some disturbance of the beam which scales the distribution of work to Britain and elsewhere—and the elsewhere has become a factor to be reckoned with in the apportioning of the various goods for the market places of the world. Competition has become keener and expedients have been adopted, with more or less temporary and questionable success, in order to secure work and its equivalents, with the object later on of capturing the market from the pioneers who were largely instrumental in creating it, and from rivals whose enterprise had not only enlarged the capacity

of the market place, but extended its scope. The necessity which springs from competition in respect to lessening the cost of production and increasing the output, compels the competitors in the direction of improvement in mechanical skill and ingenuity, in material, in machinery and in method of work. There is also the other direction which some advocate of compelling the National Exchequer to support and protect those industries which cannot or will not protect themselves in the more legitimate direction already indicated. The Colonies now comprising the Commonwealth of Australia and the Dominion of New Zealand have reached the stage at which the desire is strong, and calls aloud for Colonial home-made goods and for Colonial home-made means for their transit across the sea, and also for Colonial home-made means of defence for their coast-line, and it would seem as if this desire is entering the first step of progress towards accomplishment.

"PERICLES."—On Monday, June 22nd, the fine new steamer *Pericles*, built by Harland & Wolff for the Aberdeen Star line (Messrs. Geo. Thompson & Co., Ltd.), was thrown open for the inspection of the public at a small charge for the benefit of a very worthy and appropriate cause, the Seamen's Hospital. The *Pericles* is a twin-screw steamer 500 ft. long by 62 ft. beam, of 11,000 tons register and is built to Lloyd's and Board of Trade requirements, with double bottom and eight water-tight compartments. The engines are quadruple balanced. The ship was launched in December, 1907, and sails early in July on her maiden voyage to Australia *via* the Cape of Good Hope. It is interesting to note that the *Pericles* is a great advance in size over the other steamers of the line, and it is fitting to refer to the history of the firm whose enterprise has brought forth such a steamer. The line was founded by Geo. Thompson, an Aberdonian who, in 1825, a year after attaining his majority, launched forth in the business of ship-owning and underwriting. Gradually the number of sailing ships increased, trading to Canada and Australia and later on to the East; some of the well-known Aberdeen China tea clippers were owned by the firm, which in the days of the Crimean war opened a London house under the jurisdiction of Stephen Thompson, eldest son of the founder, of the line, William Henderson, son-in-law of Geo. Thompson, being also a partner in the firm. The beautiful and well-built ships of forty years ago engaged in the races home with China tea for the market we can well remember, and the excitement caused by the news of arrivals and the days occupied on the voyage. The romance of the sea was then more pronounced than it is to-day, and we listened to many yarns which fired the blood as we heard of the press of canvas carried to take full advantage of the breeze, even at the risk of carrying away a spar. Those days are gone, but the name of the *Thermopylae* conjures up the names of others, the pictures of which rise before us now. The passage from sail to steam was made by the firm when in 1881 the *Aberdeen* was built by Napier on the Clyde and with triple-expansion engines and a great advance in steam pressure, for the design and introduction of which Dr. Kirk was responsible. The *Aberdeen* became the pioneer for the advance in pressure and was soon followed by many other steamers in 1882, 1883 and 1884 by different builders for other lines. Messrs. Denny and Co. adopted the tandem-quadruple, and built several for the British India Co. about 1884, with the advanced steam pressure. The *Aberdeen* was the first steamer built for the line, three years after the *Australasian* came forth, then the *Damascus*, *Thermopylæ*, *Ninevah*, *Moravian* and *Salamis*. Then came the *Miltiades* and the *Marathon*. Some of the older steamers have been sold, and the fleet now consists of three twin-screw and two single-screw steamers, in all of which every attention is paid to the comfort and convenience of passengers bound for Australasia or homeward-bound travellers looking forward to revisiting the scenes of early days or to paying their first visit to the land of their fathers.

MESSRS. HARLAND & WOLFF'S SOUTHAMPTON WORKS.

BY the courtesy of Mr. Crighton, Managing Director of Messrs. Harland and Wolff's at this port, we are enabled to give a short description of the extensive and up-to-date shipbuilding and engineering works which are now completed at Southampton Docks.

The works are situated near the new Trafalgar Dry Dock, which is one of the largest dry docks in the world, having an over-all length of 875 feet and a depth over the blocks at H.W.O.S.T. of 33 feet 6 inches, and is thus capable of docking the largest liners afloat.

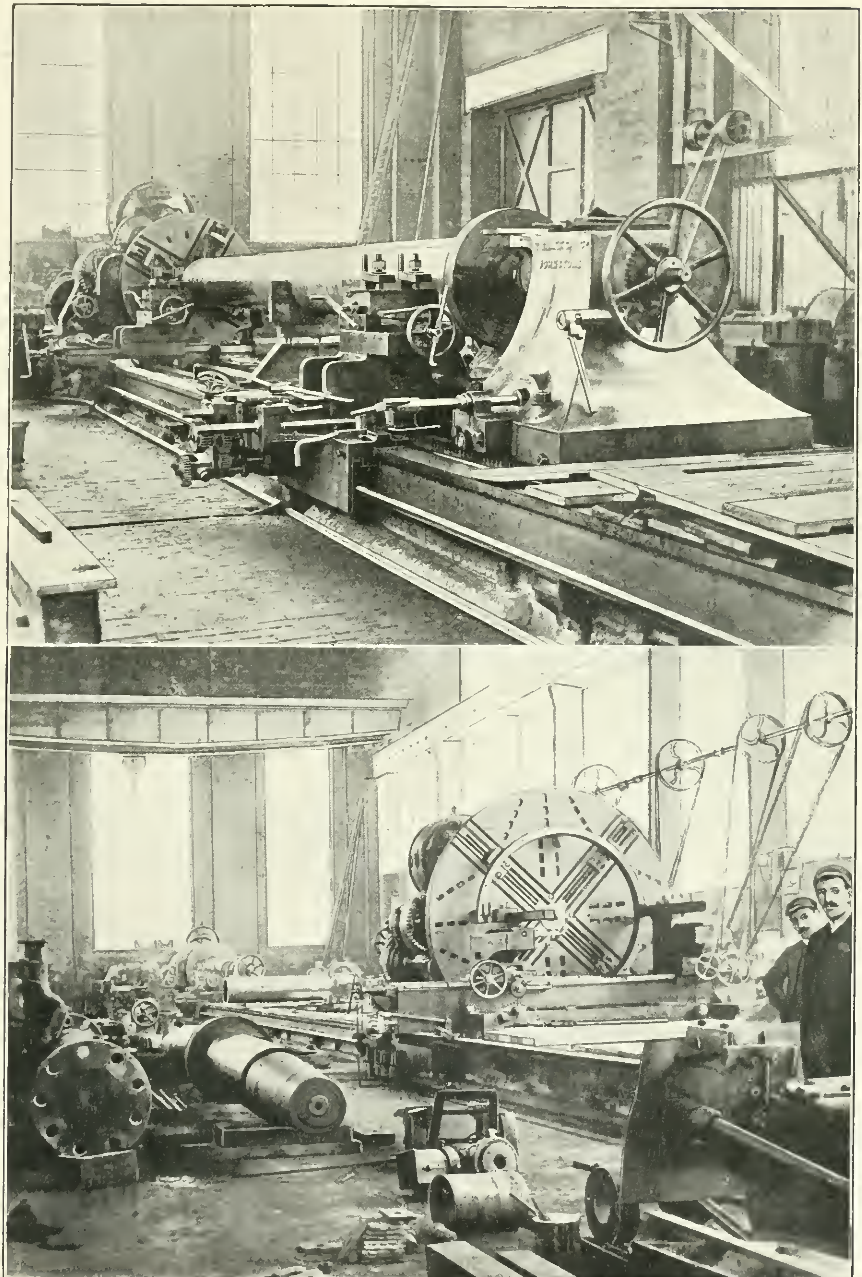
The new wet dock, which is under construction by Messrs. Topham, Jones & Railton, is also adjacent to the works. This new dock will be capable of berthing the largest liners. It covers an area of about sixteen acres and is 1700 feet long and 400 feet wide, and when completed will have a depth of 40 feet at L.W.O.S. tides. From the above it will be seen that the works occupy an ideal position; they have rail connections with the main dock lines, and thus trucks can be run right into the works and under the large electric crane. The area enclosed by the works buildings is approximately two and a half acres.

The main offices, stores, etc., are substantial red brick buildings of handsome design, and internally the offices have a particularly clean and light appearance, being constructed of white glass tiles, and all the woodwork is painted white. Each is lighted by bronze portable electric-light standards of massive design and heated by a large steam radiator.

The entrance gates are of imposing appearance, and are constructed of ornamental wrought-iron work. Just within these gates there is a large weigh-bridge.

To the left of the entrance gates is the heavy machine and fitting shop. This splendid shop runs nearly at right angles to the Trafalgar Dry Dock. At right angles to this shop, and running parallel to the dry dock, is a very large boiler shop with an equally large shop above, part of which is at present equipped with light capstan lathes, etc., for brass-finishing work. The blacksmiths' shop is at the main entrance end of the boiler shop. Facing the entrance are the following shops:—Brass foundry, coppersmiths' shop, tinsmiths' and plumbers' shop, joiners' shop, over which is the light joinery workshop and polishers' shop. The buildings at the end near the main dock entrance contain the electricians', paint and riggers' shops. The sailmakers' and upholsterers' shops are above the general stores, and on the ground floor in the centre are the time offices and workmen's entrances, foremen's rooms, and at the end extending to the entrance gates are the general offices.

Reverting to the Heavy Machine and Fitting Shop. This splendid shop is equipped with some very fine and up-to-date machinery, including a number of lathes by Messrs. Craven Bros., John Lang & Sons and Thos. Shanks & Co. Messrs. Buckton & Co. has supplied several planing machines, and Messrs. Asquith a very large radial drill also. Messrs. Harvey have supplied some small drilling machines. The large shafting lathe, which is capable of dealing with shafts up to 55 feet in length, has been supplied by Messrs. Thos. Shanks & Co., Johnstone. We give a



Messrs. Harland & Wolff's Southampton Works.

capital illustration of this machine. All the principal machines are driven by independent motors by Messrs. Laurence, Scott & Co., Ltd., Norwich, and thus each machine is an independent unit. The motor drive can be distinctly seen in the illustration of the large shaft lathe mounted at the top of the machine. There is a large 30-ton electric overhead crane by Messrs. Craven Bros., which can feed any of the machines in the shop. This shop has windows at the sides and ends and the sides and roof are of corrugated iron on a steel framework. The end near the offices is constructed of red brick to harmonize with the office buildings. There is direct rail connection into this shop from the dock lines, and by means of the large crane above referred to weights can be lifted out of the railway trucks and deposited where required.

This shop is electrically lighted by nine enclosed arc lamps suspended just under the roof.

The large boiler shop is of steel and corrugated iron construction, at the entrance of which is a large switch-board with connections for the various instruments for the electrical supply for the works. The most notable machines in this shop are the large horizontal rolls by Messrs. James Bennie & Sons, Glasgow, which can take a plate 34 feet long by $1\frac{1}{2}$ inches thick, the large double-punching machine by Messrs. J. Cameron, Ltd., Manchester, which is capable of punching $1\frac{1}{2}$ in. plates, and a large motor-driven beam bending, punching and angle-shearing machine by Messrs. Craig & Donald, which can deal with plates of a similar thickness. The motors in this shop, as in the machine shop, are by Messrs. Laurence, Scott & Co., Limited. Other machines include a smaller punching and shearing machine by Messrs. Cameron, some light plating rolls by Messrs. Bennie, and a large double-head scarfing machine by Messrs. Hugh Smith & Co., of Possil Works, who have also supplied light plating rolls and a large motor-driven plate edge planing machine. There are two furnaces in this shop, and in front of the furnaces there is a large frame bending table. Beyond this, at the bottom of the shop, is the blacksmiths' shop, which is equipped with two of Messrs. B. & S. Massey's pneumatic hammers, one being a 10 cwt. and the other a 5 cwt. hammer; both are motor-driven, and we understand an additional hammer of 20 cwt. is still to be delivered.

The following shops are at the back of the main offices, and separated from them by a large open yard:—Brass foundry, coppersmiths' shop, tinsmiths' and plumbers' shop, joiners' shop, etc.

The brass foundry has a large stove for core-drying, four pots for melting purposes, large coke bin and ample floor space for future extensions if found to be necessary.

The coppersmiths' shop is well equipped. There is a handy motor-driven pneumatic hammer by Messrs. Piercy & Co., Birmingham; a circular saw by Messrs. J. McDowall & Sons, Johnstone; and Messrs. Tangye have supplied a double-plunger hydraulic-pressure pump for pipe testing and bending. The pump is capable of pumping to a pressure of two tons per square inch. There is also a hydraulic horizontal pipe-bending machine.

The tinsmiths' and plumbers' shop is fully equipped with the latest type screwing and drilling machines, also a handy small pipe-bending machine.

The joiners' shop has two storeys, and on the ground floor has a motor-driven circular saw, band saw, drills and a large special sawing machine by Messrs. Ransome, of Newark. There is also a machine by Messrs. J. McDowall & Sons combining chisel and drill.

The works have been erected by the Waring White Building Co., and the structural steelwork was supplied by Messrs. Dorman, Long & Co., of Middlesbrough.

In these splendid new works, so briefly and inadequately described, Messrs. Harland & Wolff will be able to handle all classes of repair work very expeditiously, and Southampton and district ought to benefit very materially by the establishment of such a well-known and old-established firm in their midst.

COCHRAN & CO., ANNAN, LIMITED.

In order to further extend public knowledge with reference to the already well-known Cochran patent vertical multitubular boiler, Messrs. Cochran & Co., Ltd., of Annan, Scotland, are issuing an ingenious little booklet setting out the special features and advantages of the boiler.

This booklet is written in the form of an illustrated interview with the representative of the company who, by means of a model readily adapted to be taken to pieces, incisively presents to the reader every special point of the boiler, while the illustrations are such as to readily indicate the particular point being dealt with. There are fifteen illustrations in all, and so far as one can judge, there is not one single one too many, nor does any particular point appear to have been missed in the series.

That the boiler is an ingenious and simply constructed device is generally conceded, as, while having a very large heating service, efficient access is afforded to every part requiring attention.

AUSTRALIA.—The mining of coal in the Colonies comprised under the Commonwealth of Australia has been carried on for many years, the mining of minerals followed, and the smelting of iron with the consequent development of the industries which hinge upon the smelting, gives promise of entering the arena of practical work, from the cells of the experimental stage. No doubt the possible success of the manufacture of iron from the ore in the course of a few years, has given birth to the idea that works and yards should be established to make use of the iron when made, and if the initiation of the coming industry is dealt with carefully and not rushed in the so-called interests of labour, without regard to the more true and enduring interests of the Commonwealth, there seems no reason why it should not do well in the course of another generation or so.

SUSSEX MOTOR BOAT CLUB.—The committee of the Sussex Motor Boat Club announce that, following upon the important part the club has taken in the formation of the International Association for motor yachting and the establishment of International Racing Cruiser Classes as the principal item of the future in all international events, it has been presented with a magnificent 125 guinea cup by Mr. A. G. Vanderbilt, who is now taking a keen interest in the rapid development of the Sussex Club. Mr. Vanderbilt, at the suggestion of the Rear-Commodore, consented to apply it to the introduction of the new international classes henceforth known as Racing Cruisers, and which are to be of a vastly superior sea-going type to those hitherto seen at the great Monaco meeting, and of sizes and powers well within the range of the average nautical sportsman's purse, and cruisers in the true sense of the term and the type deserving of the greatest encouragement in British waters. The opportunity of holding the "Venture" International Cup (which is the title by which Mr. Vanderbilt wishes the Cup to be known) will undoubtedly have the effect of bringing the best British boats to the Brighton Regatta, which takes place on July 14th, 15th and 16th, and prospective competitors are invited to apply to the Secretary for fuller particulars.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The White Star Line,

who have maintained their weekly cargo service from Liverpool direct to New York for upwards of twenty years, have now discontinued it, at all events for the present. The reasons which have induced them to take this step are based on the policy of the railroads on the other side, it being stated that rates are now so much in favour of Canadian routes that it no longer pays to carry produce from New York to Liverpool. The cost of transport between interior centres of production and Montreal is 2½ cents per bushel less than that *via* New York, and similar differences are alleged to exist in respect of transit *via* Philadelphia, Boston, Baltimore and other large seaports on the Atlantic sea board of the United States. The fact of this difference in cost of transit from Canada and the States seems to be beyond question, but there is some divergence of opinion as to its causes. The Canadian authorities assert that the difference is due to the more favourable situation of Montreal as a port of shipment, whilst the managers of the White Star Line allege that the railroads are discriminating in favour of Canadian ports. They call upon the railroad managers to enter into a closer co-operation with the steamship companies if they wish to retain even a small portion of the export trade for United States ports. The position, therefore, seems a little curious. For those who watched the genesis of the International Mercantile Company—better known perhaps as Mr. Pierpoint Morgan's Combine—will remember that one of the principle justifications of the amalgamation was the allegation that the union of the interests of the Atlantic Steamship Lines with those of the great railroad King would lead to great economy of transit between inland centres of production in the United States and the ports behind which lies the British consumer. The White Star Line is, of course, one of the principal, if not *the* principal, constituent in the Combine, and it seems a little strange under the circumstances, that they of all people, with Mr. Morgan's influence to assist them, should be obliged to shut down their cargo service in order to emphasise their demand upon the American railroads for this closer cooperation. Anyhow, five White Star Steamers, the twin-screw *Georgic*, *Cevic* and *Bovic*, and the single-screw *Armenian* and *Victorian* (formerly of the Leyland Line), are temporarily out of a job.

The "Hohenzollern."

Though the old Nord-Deutscher Lloyd Steamer *Hohenzollern* has been rescued from her dangerous position off the coast of Sardinia, the stranding has nevertheless been fatal to her. After being floated and provisionally tightened, she was towed by two salvage steamers to Genoa, and there examined. The damage to her hull proving to be more extensive than had been supposed, it was decided that she was not worth repairing; accordingly she was sold for a sum of £12,000, to the firm of Messrs. Pittalunga of Genoa, who propose to break her up at that port.

It is reported that steps are being taken by the Hamburg American Company to dispose of the wrecks of the two liners *Prinz Waldemar* and *Princessin Victoria Luise*, which stranded on the coast of Jamaica, about the time of the lamentable earthquake at Kingstown.

German Steamship Enterprises,

save indeed one or two highly fortunate lines, seem to be doing badly enough at the moment. The German Levant Line, for example, has had such ill luck that a drastic scheme for reconstruction is to be placed before the shareholders. Under it the existing capital of £300,000 would be written down to half that sum, whilst additional capital to the extent of another £150,000 is, if possible, to be added. Scaling down capital does not really affect shareholders, for a holder of stock gets the same share of the profits if any, whether he holds a nominal £1,000 in a capital of £300,000 or a nominal £500 in a capital of £150,000. What does matter to him, is when new capital is introduced and thus his chance of dividend is in future to be shared with the new comer who has brought needed money into the concern at a time of crisis. It appears that this German Levant Line started a Mediterranean service in conjunction with the Nord-Deutscher Lloyd just two years ago. To the end of the year 1907, the working of this line had cost it about £23,000 before it was abandoned, and this total is irrespective of the money expended in adapting three vessels of its fleet to the requirements of this special trade. It seems also to have lost something like £44,000 in depreciation of its shares in the Compagnie Nationale Belge de Transports Maritimes.

So too the Hamburg-Bremen-Africa Line has to regret its decision to enter the trade to the West Coast of Africa. It was met by a ruinous competition with the old-established Woermann Line, which now has the backing of the all-powerful Hamburg-American Company. This competition is now at an end, an agreement having been reached between the rival companies. But the financial scars of the struggle remain; for the Company's floating debt trebled during the year 1907, rising from £50,000 to £150,000, whilst the debit to profit and loss, after allowing something for the depreciation of the fleet, exceeded £50,000.

The Atlantic Cable Companies

are feeling the results of the multiplication of large steam trawlers. The Commercial Cable Company complains that, within the last three months, it has expended not less than twenty thousand pounds in repairing broken cables off the West Coast of Ireland, and it alleges that this constant breaking is due to the action of the trawlers. Proofs of this allegation are afforded by the fact that when the damaged ends of the cable have been brought to the surface, portions of broken trawls have been found attached to them. Thus it would appear that it is as much in their degree to the interest of the trawlers to avoid interfering with the cables as it is to that of the Telegraph Companies themselves. The matter is a serious one, for, after the repairs had been executed and everything put in order, no less than three fresh interruptions occurred in three following days. There seems to be some objection from, I suppose, a military point of view, to showing on the chart the exact position of the wires. But surely it might be possible to induce the skippers of these craft, under the direction of their owners, to avoid a zone which would include the shore ends of all these important means of intercommunication between the two continents.

Shipping Rings.

At last, after so long a period, the taking of evidence by the members of the Royal Commission on Shipping Conferences is finally concluded, and the next stage will be the publication of the report. Some valuable information has no doubt been elicited in the course of this most protracted and useless inquiry. But the cost will have been prodigious, whilst possibly our trade rivals abroad may have learnt a wrinkle or two which will avail them in their fight against our shipowners and merchants. At the same time an immense amount of the information laid before the commission has been the merest hearsay and surmise and utterly outside anything that a lawyer would admit to a Court of Justice.

The Russian Volunteer Fleet

has just set to work in the Atlantic trade the large twin-screw liner *Russia*, which it has built for the special requirements of the trade between Libau and New York. Just as this vessel is setting out upon her maiden voyage comes the suggestion that, owing to the unproductive results of the operations of this service, it may have to be discontinued.

The Increase in the Size of Steamships

is involving the owners of the more inportamt waterways in heavy expenditure. At the beginning of June the management of the Manchester Ship Canal announced that, after some three years' continuous work, they were in a position to allow vessels up to a draught of twenty-eight feet to pass along the canal. A similar draught is allowed in No. 9 dock—it having deen designed for this depth. In the case of the other docks, the task of deepening still remains to be accomplished. The work—for which Parliamentary sanction was obtained as recently as the session of 1904—has been arduous, as for considerable distances the bed of the canal is red sandstone, which had to be dealt with in the first instance by Lobnitz rock-cutters, the soil thus loosened being afterwards raised by the dredgers.

The Suez Canal in the same way has just completed the work of bringing its waterway to a similar depth. At the same time it has increased the radius of the Timsah curve with the view of facilitating the passage of larger vessels. But perhaps the most arduous part of its work is the scheme of widening, which is now in progress. It is intended that the Canal throughout its length shall have a width equal to that now to be found only where there are sidings to admit of the meeting of steamers passing in opposite directions. The completion of this undertaking will occupy some four or five years, and will assuredly be a costly business enough. But there can be no doubt of the advantage to be reaped in return for this expenditure. For not only will the canal—whose business seems now to be increasing at the rate of upwards of a million tons of shipping a year—be able to deal with a larger volume of traffic, should there be any sign of the limit of present capacity being reached—but it will also enable steamers to make the transit in considerably less time than that at present occupied, and that although improved arrangements seem year by year to be shortening the average time taken in passing between Port Said and Suez.

Collisions.

A collision which placed two of the most important steamships of the South-Eastern and Chatham Company's fleet in serious jeopardy, occurred in mid-channel on the afternoon of Saturday, the 31st May. The turbine steamer *Onward* was bound for Boulogne in the noon-day service on that occasion, whilst her sister, *The Queen*, was coming towards Folkestone. Thick fog fell on the Straits of Dover, and whilst the two vessels were proceeding with every caution at slow speed and sounding their syrens, they suddenly found themselves on the point of collision. It was then apparently too late to avoid the contact. But everything was done to minimise the effect of the blow, whilst the bulkhead doors throughout both ships were promptly closed. The *Onward* was struck but four feet from the stem, and her look-out man was unfortunately killed. The bows of *The Queen*, too, were badly buckled. As soon as the extent of the damage sustained by the two ships was realized, it was determined that the wisest course was for them both to proceed slowly and carefully to Folkestone, and this was adopted, the vessels reaching port without further mishap. The repairs necessitated by the accident will keep the vessels off their station for some little time, the paddlers *Calais* and *Empress* being detailed to take their places during their absence.

The Russo-Japanese War.

It will perhaps hardly surprise those who know anything of British official methods and of the contempt with which our protests are nowadays treated abroad to learn, on the authority of Sir Edward Grey, that a complete *impasse* has been reached in the matter of those shipowners whose vessels were wantonly subjected to outrage during the continuance of the struggle between Russia and Japan. In the case of the steamship *Knight Commander* of Liverpool, for instance, it was hoped that though the Russian Courts had found against the claim of the owners for compensation for the sinking of their vessel, there might be place for amicable arrangement if the matter could be submitted to arbitration. But at last, as the years go on, Sir Edward Grey calmly announces in the House of Commons, in reply to a question, that the Russian Government has declined the proposal of the British Foreign Office that the matter should go to arbitration. Our Ministers are now "considering what further steps may be taken" in the matter. I hardly think statesmen of the days of Lord Palmerston would have taken much time to think out what they would have done under such circumstances. Even from our Japanese allies, in the case of the steamship *Mukden*, they have not succeeded in obtaining any satisfaction. Powerful as is reputed the influence of the great P. & O. Company, it should be remarked that they have not yet obtained their compensation for the outrage on their steamship *Malacca*, which as my readers will remember was captured by a Russian Volunteer cruiser, and retained for sometime a prisoner on the ground that she was carrying contraband of war. It was conclusively proved at the time that the contraband in question was Government stores for the use of His Majesty's forces abroad!

The New Cunarders

still continue to improve on their own performances. I mentioned in the last Notes that the *Mauretania* had been detained at Liverpool from the sailing of the 23rd to that of the 27th May, because of the damage to one of her propellers. It was found when she was dry docked that the damaged blades could not be replaced in the time at the command of the engineers, so it was decided to send her to sea with but three screws. This was done, and nevertheless she lowered the record for a day's steaming, bringing the figure for a day to the westward up to 635 nautical miles, which means the maintenance of 25·5 knots. Her mean speed for this trip was 24·86 knots which is ·03 knots better than the previous best made by the *Lusitania*. That ship, however, was not to be beaten, and, on her next westward voyage pulled the day's figure up to 641 nautical miles, further improving the mean speed for the whole run by ·03 knots again, and thus lowering two records by her performances.

The "Suevic."

The wreck of the *Suevic* involved the White Star Company in a curious litigation with the County Council of Cornwall. When this ship was dynamited in two, a large number of carcases of mutton floated out of her insulated holds and many of them came ashore on the Cornish Coast. Under the provisions of the Diseases of Animals Act, these carcases were buried or otherwise disposed of, and a claim for something over fifty pounds, for the cost of doing this, was preferred against the shipowners by the County Council. The shipowners, however, disclaimed liability and the County Council sued them in the County Court. The defence was that these were not carcases in the sense intended by the statute, it being urged that what the Legislature desired to touch was the case of beasts which had been shipped alive and had met with disease at sea. The County Court Judge, however, held that this was not the case, and that the dressed carcases were equally carcases within the meaning of the Act. Attaching great importance to the decision, as it might mean a good deal to a shipowner on occasion, the White Star Line appealed to a Divisional Court, and when it affirmed the judgment of the County Court they asked for leave to take the case still further.

The report of the International Mercantile Marine Company is not altogether, I take it, satisfactory reading for the shareholders. The gross earnings, it is true, amount to the important sum of £7,853,000 sterling. But the nett earnings are but £800,000. This does not seem a vast return on so vast a capital as theirs—and this is especially so when we see that in arriving at nett profit they make no allowance for depreciation of plant. When this needful provision is made there is but a paltry £40,000 left to carry over. The depreciation and insurance funds stand now at £2,200,000. But I doubt whether this is an excessive amount for a fleet of upwards of eleven hundred thousand tons. The assets of the Combine are stated at just under thirty-nine millions sterling in the balance sheet, and it is claimed that there is a surplus of assets over liabilities of £82,000. The ships under construction include the two 14,000 ton vessels for the St. Lawrence trade, a big liner for the Atlantic Transport Line, another for the Red Star Line, which has already been strengthened by the transfer of the *Gothic*, and by a vessel to take the place of the *Gothic* in the New Zealand trade. Most of these ships will, it is hoped, be at work in the year 1909.

The West India Royal Mail Company,

in seeking new outlets for its energies, has taken over the Morocco fleet of Messrs. Leech, Harrison & Forwood of London and Liverpool. This fleet includes the new steamships *Arzila* and *Agadir*, recently completed at Sunderland, and only put in the service during the current year. It would also appear to include the older, but still favourite, passenger liners *Zweena*, *Oratava* and *Morocco*, recently announced as for sale by auction by Messrs. Kellock's, but subsequently withdrawn. These three ships seem, however, within the last few days, to have been again placed in Messrs. Kellock's hands for disposal. The Forwood line had an excellent cargo connection with the North-West Coast of Africa, and its steamers were great favourites with passengers and tourists, the circular voyage by the line being a much appreciated holiday trip. The Royal Mail thus acquires a living property

and one which is no doubt capable of considerable development in capable hands. I understand that the Elder Dempster Co. is also aiming at a share in the Morocco trade, but their idea seems to be that they can tap it by using their existing service as far as the Canary Islands. I much doubt if a new line which only works by transhipment in this way will make much progress in competition with one which proceeds direct and has not only the ships, but also the men who during a long course of years have been learning the trade and getting to know the peculiarities of the customers who have goods to ship.

The "Gladiator" and the "St. Paul."

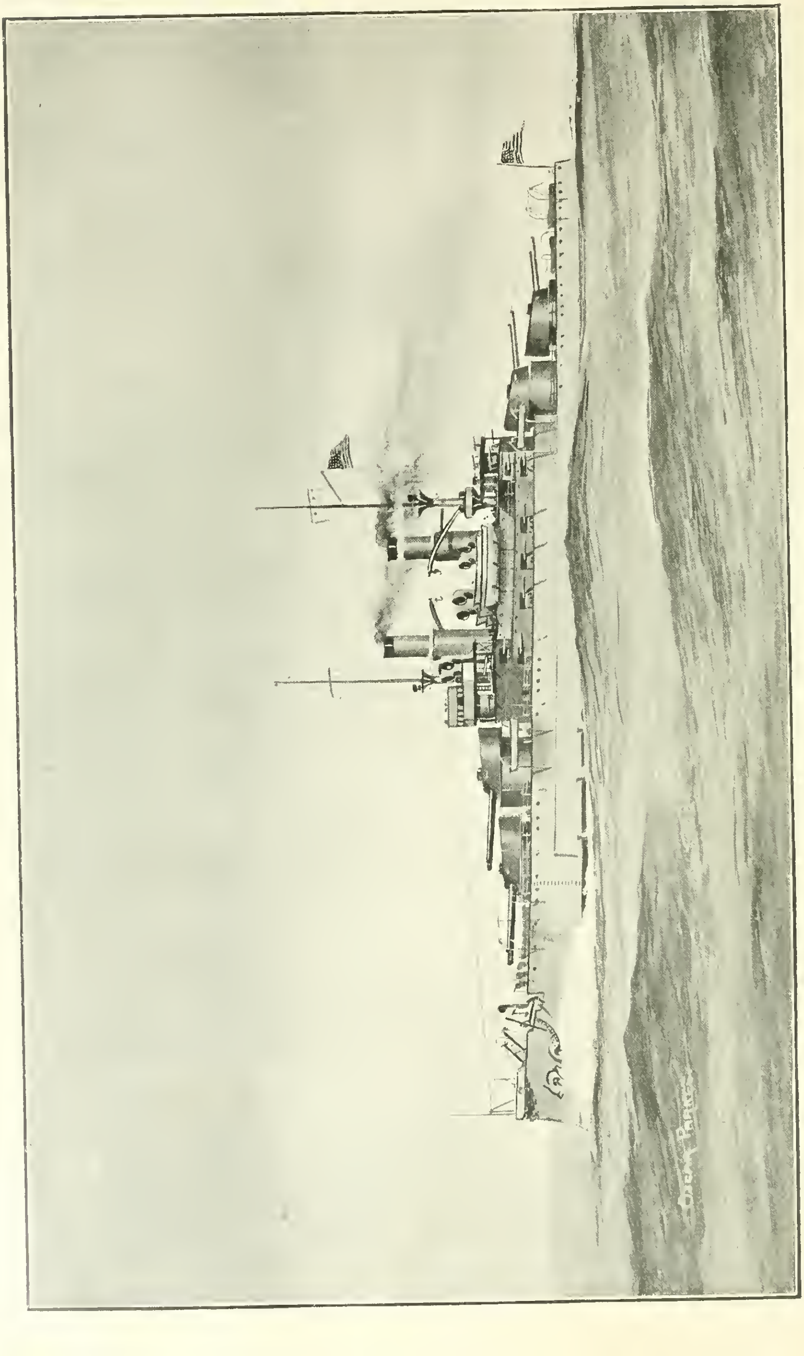
The sentence of the Court Martial on Captain Lumden of H.M.S. *Gladiator* was that he be reprimanded and dismissed from H.M.S. *Victory*, the charge against him of hazarding his ship being held to be partly proved though it was considered by the Court that there were two mitigating circumstances. One was the conduct of the *St. Paul* which, it was held, broke by her conduct two of the Regulations for the Prevention of Collisions at Sea. These were the one enjoining moderate speed in fog, thick weather or falling snow, and that entailing the use of sound signals under such atmospheric conditions. Further the conduct of the Captain and crew of the *Gladiator* after the collision was held—and rightly so held—to be everything that could be desired or expected even of British seamen. Thus in the view of the Court Martial really both ships seem to have been to blame. The learned President of the Probate, Divorce and Admiralty Division does not believe in this verdict of both to blame. He holds that the collision was solely due to the action of the *Gladiator*. The vessels when they first sighted one another at a distance of half a mile were slightly port to port. Had they kept their courses there would have been no collision. Sir John Gorell Barnes does not hold that the *Gladiator* was right in its belief that the *St. Paul* was either starboarded or blew a two-blast signal. The *Gladiator* herself starboarded, and that put her into collision—a catastrophe which could not be averted by the action of the *St. Paul* in putting her helm hard to port and reversing her starboard set of engines in order to aid the rudder. The *Gladiator* was undoubtedly before the collision in a snow flurry, but the President holds that the *St. Paul* was in weather clear enough to exonerate her from any blame for not going slower or for not blowing her whistle. He then disposes of the claim of the Admiralty in respect of the damage to the *Gladiator*. But he leaves the cross suit by the American Line in respect of the damages to their vessel for future dealing.

THE INSTITUTE OF MARINE ENGINEERS.—Two interesting events took place in connection with the officials of the Institute of Marine Engineers during the month of June, which is pre-eminently regarded as the month for weddings. On the 6th, the Honorary Treasurer, Mr. Alexander H. Mather, led to the altar Miss Agnes Anderson, a sister of one of his fellow members, at present stationed in the East. Mr. and Mrs. Mather carry with them the good wishes of all the Members of the Institute for their future welfare.

Another equally felicitous occasion to be chronicled here which marks a milestone in the matrimonial journey, was the Silver Wedding of the Honorary Secretary. Mr. and Mrs. James Adamson celebrated the 25th anniversary of their marriage on 21st June, and we feel sure, that all our readers will join with us in expressing a hope that they may be spared to celebrate their full Jubilee, and be enabled to continue those acts of kindness and thoughtfulness, for which they are honoured and remembered by a very large circle of friends, both at home and abroad. During the greater part of this period, Mr. Adamson has devoted most of his spare time to organizing and maintaining the affairs of the Institute of Marine Engineers, which attains its majority in about another year. The splendid record of the work done, as submitted at the Annual General Meeting of the Institute held on March 20th last, when the Annual Report showed a total existing membership of 1010, an excellent balance sheet, which included on the credit side, freehold property and furniture worth £2,000, and Consols, Stock and Cash value £1,400, is the most eloquent testimony of the great success which has attended his labour—a labour of love in the fullest sense, in our appreciation of which his good lady must share.

UNITED STATES BATTLESHIP "MICHIGAN."

THE battleships *Michigan* and *South Carolina*, now under construction at the New York Shipbuilding Company and Cramp yards respectively, are the first American ships to carry an "all-big-gun" armament. They must not, however, be considered as replies to our *Dreadnought*, or as "embodying the lessons learnt during the late war"—the phrase attached to the design of every modern ship—for the reasons that the plans were drawn up before the *Dreadnought* materialized and prior to the battle of Tsushima (which seems to have become the graveyard, metaphorically speaking, of all two-calibre gunned battleships—at least for the present). The 6″ and 4·7″ guns will come into vogue again, but not so much as a secondary armament for battleship attack as for defence against torpedo boats. In our May issue we dealt with H.M.S. *Invincible*, which carries the same armament as the *Michigan*, but represents the alternate method of disposing the guns, *i.e.*, two fore and aft in the centre line and one on either beam *en échelon*, as against the eight in the centre line, with the second and third turrets raised to fire over the fore and aftermost. These dispositions give six ahead and astern and eight on either beam (two guns having a very limited arc of fire), and four ahead and astern and eight on either beam with normal arcs respectively. We do not propose to make any comparison between the *Michigan* and *Invincible* as fighting ships, as each is suited for its particular sphere of action, speed having to be sacrificed for armour in the first case and armour for speed in the second. In the main features of the designs, however, it is possible to sum up the *pros* and *cons* of this typical American battleship and British so-called "armoured cruiser," and strike a balance in favour of one or other of the gun dispositions. Taking the American ship first, we may say right now that the type is not going to be multiplied, the later *Delawares*—which we shall be dealing with shortly—being very much larger vessels and carrying ten big guns. At the same time, however, the position of the turrets has been followed out, and an additional pair of guns right aft, being on the same deck as the *Michigan's* aftermost turret, augments the broadside fire, but not the end-on. The obvious conclusion is, then, that American ships are designed for broadside attack, and an all-round fire has been sacrificed in order to obtain this. The *Michigan* has the same beam fire as the *Dreadnought*, owing to the amidships pair on either side of the latter having no cross-deck bearing; but these reserve guns would certainly tell in an action, as they would come into play with the crews fresh and the mountings and hoists untouched, when the *Michigan* would have been working all her gun positions and having them exposed from the commencement of the action. The question arises, Is it better to have this reserve or so mount the guns that all can come into action on either beam simultaneously; or, to cite cases in point, is the *Dreadnought* preferable to the *Delaware*, other things being equal, both ships carrying ten 12″ guns as they do? Only actual war experience can decide this. We are inclined to favour the English ship, as



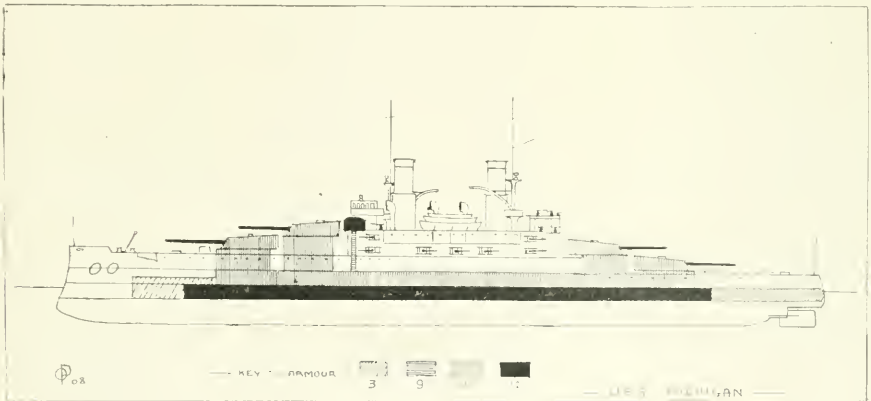
The United States Battleship "Michigan."

the arrangement of her guns was decided upon in the face of every other possible disposition, and the superimposed turret notion would have been adopted had it presented any improvement on the arrangement decided upon. The later *Téméraires* were at first reported to have the first of the after turrets raised to fire dead astern; but this has been denied in several quarters as unlikely, and from the fact that only one of the hoists (for the forecastle turret) is abnormally long we gather that the remaining guns are on the same level. The *Michigan's* guns, in the opinion of naval circles this side, are going to cause a lot of trouble with blast interference. Although the muzzles are well over the roofs of the lower turrets, there cannot possibly be the same freedom and isolation from this that our gunners have, and nothing is so likely to discompose accurate gunnery as the blast from 12″ guns a few feet above the sighting slots. Against this the ship could not have carried the armament she does and obtained the same broadside fire with the alternate arrangement—another

will be seen from the appended particulars of the *Michigan*, she is 450 feet long with a mean draught of 24½ feet, so that her top weight is rather out of proportion to her dimensions.

The worst feature of the ship is her short belt, which leaves the bow and stern unprotected. The main water-line strake is 12″ thick amidships, and tapers to 10″, where it stops short a little beyond the end barbettes. The thin 1½″ continuation to the stern and half-way to the bow means that she is practically a "soft-ender," like the *Royal Sovereigns* are, with no reinforcement for ramming in any way. The topside and quick-firing battery amidships is unprotected, the whole of the armour being concentrated round the big guns and belt.

With a designed H.P. of 16,500, a speed of 18·5 knots is expected. The *Connecticut*, with the same power, length, and 3 feet less beam reached this speed, so that the under-water lines of the new ships must be particularly fine.



50 feet would have had to be added to the length. She therefore represents the best possible design for her requirements that could be obtained on the displacement, with the drawback of undue blast when in action end on. When, however, the extra length absorbed by the *en échelon* arrangement amidships can be allowed, the British arrangement is undoubtedly the better. It will be noted in passing that the *Michigan's* guns are on three different levels, the fore having a command of 24 feet, those firing over 32 feet. The third turret is the same height as the fore, while the aftermost pair of guns are correspondingly lowered to 18 feet above the water-line. While ensuring a dry forecastle in a sea-way, the height of the foremost guns has necessitated the second pair having an abnormal elevation; the thickly armoured barbette is 12 feet in height, and, with the heavy-gun house on top, the tendency to roll will be hardly counterbalanced by the 80 feet beam. The *Invincible* is 560 feet long, and her forecastle guns are 31 feet above water; the *Dreadnought* is 520 feet long, and hers are 28 feet only with a beam of 82 feet. As

In appearance the *Michigan* will be unique. The superstructure is crammed between the turrets to such an extent that the masts have had to be placed beside the funnels, that forward to the starboard and the main to the port. The boat-derricks are of a new pattern, being swung from the base of the masts, which carry the usual search-light and compass platforms. No range control tops are provided in the original design, but these may be fitted as an afterthought, probably on the miniature Eiffel tower structures now coming into favour on the "other side." Both ships are to be completed in June, 1909.

U.S.S. Michigan.

Normal displacement, 16,000 tons. Full load, 17,650 tons. Length (w.l.), 450′. Beam, 80¼′. Draught (mean), 24½.

Guns:—8 12″ in barbettes, with 12″-8″ sides, and 10″-8″ bases. Arcs, 270.

- 22 14-pounder quick firers.
- 16 smaller guns.*
- 2 submerged 21″ torpedo tubes.

Armour: —12″-10″ belt amidships, 8 feet wide. $1\frac{1}{2}$″ ends.
10″-8″ lower deck side (300 feet).
3″ armour deck, enclosing vitals of ship.
12″ conning tower with 9″ communication tube.
10″ bulkheads.

Machinery: — 2 sets vertical 4-cylinder triple expansion.
2 screws (outward turning).
12 Babcock and Wilcox boilers, with economisers.
Designed H.P., 16,500 = 18·5 knots speed.

Coal: — Normal, 900 tons. Maximum, 2,200 tons.

Complement: —869 officers and men.

The unwritten laws which govern, and which ought to govern, humanity in respect to general conduct differ to some extent according to the teaching, training, and traditions surrounding each particular community. The sense of justice and fairness requires to be exercised to keep it alive and active; if the opportunity is lacking in one's daily intercourse with one's fellows, the daily press affords opportunity for comment and judgment upon cases which occur in the lives of others as depicted in the incidents detailed by the reporter. The importance of keeping up the standard of justice and fairness is very manifest, and it is no less the privilege than the duty of all good citizens to uphold and appreciate it. The right to work and labour in any particular sphere should be conceded to everyone so long as he proves his fitness for the work he professes to be able to undertake. On the other hand, the employers of labour ought to have the privileged option of hiring those whom they find most suitable for their own particular class of work, with the proviso that these have the necessary qualifications. It is unfortunate that inordinate greed of gain has introduced elements into our national life which have been productive of dishonour and a disturbance of that good understanding which ought to exist between co-workers towards the same end—the national weal as well as individual gain—the economical production of marketable goods as well as the filling in of the day by the routine of labour. There is a tendency as cases of dishonour and dishonesty multiply, to minimise the enormity of the offence by familiarizing the average mind with the idea of such offences, and lessening the effect of the best deterrent against evil doing, namely, the high ideal and the aiming at a high standard as a rule of conduct. The risk and fear of punishment is a deterrent to some extent but it is a less powerful one, and at the same time on a lower mora plane, fearing to act dishonestly or dishonourably lest one should be found out is simply another way of putting the proposition that one would rob another but for fear of the law. The cause of labour, as the cause of capital, has suffered greatly, and the national well-being has suffered by the inconsiderate and ill-judged exposition of the few whose zeal for beating the big drum is not tempered by the necessary skill in handling the sticks. There are also others who seem to think it no robbery to their employer to idle their time and use their selfish proclivities to hinder the honest employment of the work and superior talent of others, with the intention of reducing all to the level of their own mediocrity. Those who act contrary to the high standard of morality, act contrary to the common weal and ought to be made to feel it. A breach of the unwritten law which forms the groundwork of morality of the public school boy, receives a species of rough handling on the part of the higher spirits, and the same methods might with advantage be adopted towards those who in matters of work or business are guilty of breaches of the standard of honour and honesty—more serious than those of the school boy because of their further-reaching effect.

Institute of Marine Engineers. The visit of the members to the Franco-British Exhibition has been postponed from July 4th to the 18th, when Mr. William P. Durtnall will read his paper on "The Generation and Electrical Transmission of Power for Main Marine Propulsion and Speed Regulation," with lantern slides.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

Our new battleship the *St. Vincent* is to be launched on September 10th, and the naming ceremony will be performed by Lady Beauchamp. The date is about a month later than was originally intended, the shipbuilding dispute having been the cause of the delay. The vessel, however, will be ready for the pennant well within two years from the time of her laying down. Considerably more than 4,000 tons of material have now been built into her, the rate of progress being considered very satisfactory. A most remarkable description of the new battleship that is to be laid down here after the *St. Vincent* is launched has appeared in a London newspaper. According to the story she is to be about 3,000 tons heavier than the *Dreadnought*, is to be armed with the new 13·5 inch guns, is to be propelled by gas engines, and consequently have no funnels. Nothing is known here, however, beyond the fact that the vessel is to be an improved *St. Vincent*, and the description appears to be purely imaginary, especially with regard to the big guns, the gas engines, the absence of funnels and the cost. The cruiser *Indomitable* arrived on June 18th, and will be commissioned for special service in conveying the Prince of Wales to Canada for the Quebec Tercentenary celebrations. Her sister vessel, the *Inflexible*, arrived on June 11th, for gun and other trials. The cruiser *Minotaur* is to accompany the *Indomitable* and both vessels are to leave here on July 15th, arriving at Quebec on July 22nd, and leaving there for England a week later. A singular accident occurred to the battleship *Irresistible* in Portland Roads on June 9th, the vessel taking in water so quickly that the engines soon became submerged. The most active measures were taken to stop the entry of the water, which the vessel was making at the rate of an inch per minute. These eventually proved effectual; but it was found necessary to have the battleship docked, and next morning she came on here escorted by the *Swiftsure*. Two of her magazines were also flooded, and this, of course, necessitated the ammunition being changed. The *Irresistible* returned to Portland on June 13th, and joined the Channel Fleet in time to leave for the cruise to Norway two days later. The despatch vessel *Surprise* has also completed her refit and rejoined the Channel Fleet. The battleship *Exmouth*, flagship of the Atlantic Fleet, which had been in hand since May 4th, has left. Only about half of her defects were attended to, so she will probably return. The *Albion*, of the same fleet, which has been in hand with boiler defects since June 4th, is to be completed by June 30th. Both vessels are to escort the Prince of Wales to Canada. The cruiser *Terrible*, which was for some time attached to the Home Fleet here, will begin to have her refit shortly, it having been arranged to spend £73,000 on her. Two large cylinders which have been under construction have been completed and will be sent to the wreck of the *Gladiator*. One of the cylinders filled with water will be secured under the bow and the other under the quarter of the vessel, and when pumped out it is anticipated that they will have sufficient lifting power to assist materially in righting the ship. A most successful piece of work has just been carried out by the engineering department under the personal supervision of Engineer Rear-Admiral Corner, C.B. It became necessary to remove a 50-ton crane to make room for the construction of the new lock. A large pair of hinges was fixed to the lower part of the crane on the inside, and the crane was then cut through, the top part being lowered to the ground by means of a pair of shears. What might have proved a most serious accident occurred on June 13th, as the cargo steamship *Bencore Head*, belonging to the Ulster Steamship Company, was leaving the harbour. After narrowly escaping the ram of the battleship *Revenge* the steamer, owing to the strong tide headed straight for the battleship *Vengeance* which was moored alongside the floating coal depot C 1, colliding with both. The battleship had her torpedo booms and net defence shelves on the port side carried away, while two large holes were made in the steamers' bow above water. The King's new yacht *Alexandra* left for the Baltic on June 3rd

so as to be available for their Majesties' use during their visit to the Czar. The yacht looks very neat, the hull having been painted black, the upper works white, and the funnels buff. The *Victoria and Albert* left the same day for Port Victoria, where she embarked the King and Queen. The old battleship *Devastation*, which, as I said last month, has been sold out of the Service, has now been towed from the Motherbank to be broken up at the works of Thomas Ward, Limited, Morecambe Bay, the purchasers.

Devonport Dockyard.

Excellent progress is being made with the *Temeraire*. The centre sets of the turbine machinery required to complete the installation have been delivered, and as soon as it is in place the decks will be closed up and the teak upper deck planking laid. The gun-mounting department are now proceeding with the mounting of the remaining four 12-inch guns. These, owing to their great length, were kept out of the vessel until the turbines were shipped. The fore conning tower and the signalling tower have been shipped, and preparations are being made for mounting the after conning tower. The conning tower is constructed of 12-inch hardened steel plates; it is oval, with a dome-shaped roof, and is bedded on a specially strengthened base. The signalling tower, which conveniently shuts on the conning tower, is of 3-inch hardened steel plates. As to the *Collingwood*, about 4,000 tons have now been built into her. This, of course, is by no means a record for five months, but then it must be remembered that the building staff is smaller than in the case of the *Temeraire*. The *Collingwood* will probably be launched at the end of October, but no date has yet been fixed. The battleship *Russell*, of the Atlantic Fleet, one of the vessels which will escort the Prince of Wales to Canada, completed her refit by June 27th. In order to ensure this being done extra artificers were employed on the auxiliary machinery. The work of preparing the *Cleopatra* as a tender to the *Defiance* to replace the old corvette *Perseus* is making good progress, and she will probably be ready to take up her new duties by the autumn. The refit of the cruiser *Andromeda*, which has been of a very extensive nature, is to be completed by July 17th. Her machinery, boilers and fittings have been thoroughly overhauled, new fire-control fittings have been installed, and her wireless equipment has been brought up to date. With regard to small craft, the destroyers *Swordfish* and *Sturgeon* have been taken in hand for a thorough overhaul of their main shafting, and also their rudder mechanism, while good progress is being made with the work of rebuilding torpedo boat No. 99. The torpedo gunboat *Sharpshooter*, which has been employed in connection with the salvage of the *Gladiator*, returned about June 28th to resume her duties as tender to the *Vivid*. A pleasing function took place at the Royal Naval Engineering College, Keyham, on June 3rd, the occasion being the annual distribution of prizes, when the awards were handed to the successful cadets by Admiral Sir Wilmot Fawkes, the Commander-in-Chief. Owing to the changes in the system of naval training the number of cadets has fallen to ninety-six, and this number by the end of August will be reduced to about sixty-five. Consequently there will be some reductions in the staff. Professor A. M. Worthington, who has been head-master for many years, is about to retire, and Mr. J. Crocker, the senior assistant master, will succeed him. An Order in Council has just been published, authorizing two Good Service Pensions of £150 a year for engineer-captains. One of these has been granted to Engineer Captain Wishart, manager of the Engineering Department here. The other has gone to Engineer Captain Saunders, chief engineer of Malta Dockyard. Two pensions of £200 a year for engineer vice-admirals and rear-admirals have also been granted, and these have both gone to retired officers. At the beginning of June, a number of Australian and New Zealand naval ratings arrived at this port in the liner *Omrah*. The contingent, which comprised two engine-room artificers, three leading seamen, one signalman, three ordinary signalmen and ten stokers, have come to England to qualify in their respective branches. On disembarking they were briefly addressed by Admiral Sir Wilmot Fawkes, who welcomed them. They were accommodated for the night at the Royal Naval Barracks, and next day they proceeded to Portsmouth. This is the second batch of Colonials who have arrived for this training.

Chatham Dockyard.

Last month the Town Council of Chatham passed a vote of thanks to Mr. Carlyon Bellairs, M.P., for his efforts on behalf of Chatham, especially with regard to dredging the Medway. Mr. Bellairs, who, it may be mentioned, was in his youth a lieutenant in the Royal Navy, in a letter acknowledging the compliment, said that the question was whether it was more economical and better strategy to develop existing dockyards at Chatham and Sheerness, or to commence to build up a mountain of expense which the creation of a new dockyard must involve, by creating a remote establishment at Rosyth. By remote he meant with regard to the distance from Germany, the country from which danger is to be feared. The battleship *Dominion*, which had been in hand for several weeks undergoing a refit, has left to rejoin the Channel Fleet. It is interesting to note that her first commanding officer, Captain Kingsmill, has gone to Canada to organize and command the Canadian Marine Service. The captain, a few days after his acceptance of the appointment, was unexpectedly promoted to rear-admiral. The appointment was doubtless made owing to the fact that Rear-Admiral Kingsmill is a Canadian by birth. The only other officer of high rank of Canadian birth in the Navy is, I believe, Admiral Sir Archibald Douglas. The battleship *Victorious*, which has been refitting for the past three months, has rejoined the Home Fleet at the Nore in readiness to take part in the manœuvres in July. The cruiser *Vindictive*, having had a thorough overhaul and repair of her machinery, has also rejoined the Home Fleet. The battleship *Albermarle*, flagship of Rear-Admiral Sir John Jellicoe, second in command of the Atlantic Fleet, came in on May 29th to be got ready for her visit to Canada in connection with the Quebec tercentenary festivities. She, however, only stayed a fortnight. One of the biggest jobs to be undertaken this year will be the battleship *Implacable*, which has arrived from the Mediterranean for a refit, estimated to cost £64,000. Seeing that the vessel has been in commission for six years, however, this cannot be considered an exorbitant sum. The *Apollo*, one of the first cruisers built under the Naval Defence Act, arrived on June 1st for the purpose of being converted into a mine-laying vessel on similar lines to her sister ships the *Iphigenia* and *Thetis*. The destroyer *Opossum*, which has had her boilers retubed, proceeded on June 10th to Sheerness to adjust compasses and to carry out steam trials. Mr. J. Williams, the foreman in the engineering branch, has delivered several lectures to the established fitters on the construction and repair of turbines. The lectures have been much appreciated, and in his efforts Mr. Williams has had the cordial support of the heads of the department. It is to be hoped that the example of Mr. Williams will be followed at the other yards.

Sheerness Dockyard.

His Majesty's yacht, the *Victoria and Albert*, came round from Portsmouth, and having embarked the King and Queen and Princess Victoria left without any ceremony early in the morning of June 6th for Reval. Quite a large squadron acted as escort. The cruisers *Natal* and *Cochrane* and the destroyers *Cherwell*, *Dee*, *Swale* and *Ure* went with the yacht to Kiel, where she was met by the cruisers *Minotaur* and *Achilles*, and the destroyers *Nith*, *Ness*, *Ettrick* and *Wear*, which acted as escort to Reval. The yacht returned on June 14th. Being Sunday their Majesties attended divine service, which was conducted by Commodore Keppel, before disembarking at Port Victoria and they also received the chief naval officers of the port. I said last month that the report that the new armoured cruiser *Indomitable* was to join the Channel Fleet was wrong. It has now been officially announced that the vessel on her return from Canada, whither she is to convey the Prince of Wales, is to join the Home Fleet at the Nore, as I said would be the case some time ago. On July 1st we shall lose our admiral-superintendent, Rear-Admiral Casement, who is to be succeeded by Captain R. H. J. Stewart, of the battleship *Africa*. The retiring superintendent was promoted to flag rank in January, when he had been here about eight months. He was, therefore, allowed to retain his appointment for a time, as did his predecessor, Rear-Admiral Startin. Another change takes place on July 1st, that being the date fixed for the transfer of the Gunnery School to Chatham. Rear-Admiral Coke will probably relinquish the command of the establishment shortly after

the transfer. He reached flag rank a week or two ago somewhat unexpectedly, and the school has up to the present only been a captain's command. The destroyer *Ribble*, which was damaged in the collision in which the *Gala* was lost, has had the below-water damage made good and she will be ready to rejoin the Eastern Flotilla before the manœuvres in July. The *Waveney* has completed her refit and rejoined the flotilla and the three other vessels—the *Welland*, *Garry* and *Boyne*—are to be ready to join by June 30th. Submarine 65, which was damaged at Yarmouth, will not probably have her repairs completed until the middle of July; C2, which has been in dock, is out of hand, as are also C3 and C4, the latter two having gone on to Harwich. On June 19th we had quite an influx of Admiralty officials, Mr. McKenna, accompanied by his wife, Sir John Fisher, fresh from the compliment paid to him at Cambridge, Dr. Macnamara, and many others. The occasion was a visit of the Prime Minister of Nepal to the *Dreadnought*, which ship was taken to sea for target practice, and the firing cannot fail to have made a deep impression upon the spectators. The targets were 16 feet by 20 feet, the range 2500 yards, and the speed of the ship 12 knots. Fifteen rounds were fired in $2\frac{3}{4}$ minutes, with four heavy guns in two turrets. Thirteen hits were made, nine from one turret and four from the other, the smoke impeding the range of the after guns. There was also an exhibition of submarines and destroyers.

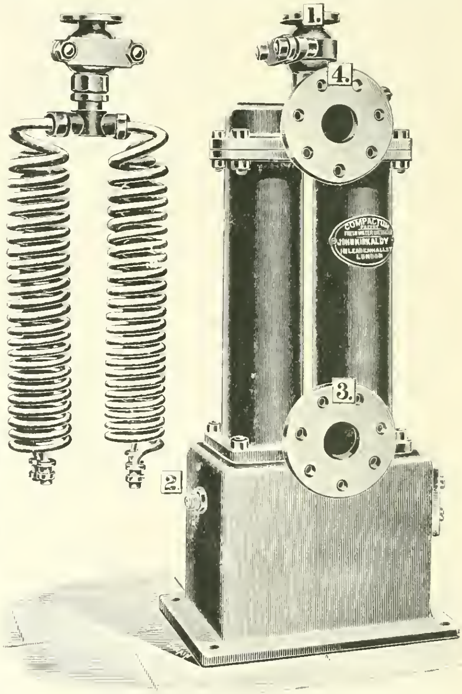
Pembroke Dockyard.

The first keel plates of our new cruiser were laid on June 15th by Mrs. Kingsford, the wife of the captain superintendent. The principal dimensions of the vessel will be—Length, 385 feet; beam, 42 feet; draught, 13 feet 6 in; displacement 3350 tons. Her armament is to consist of six 4-inch quick-firing guns, and she is to carry two torpedo tubes. The vessel will be equipped with turbines of 19,000 horse power, which, it is anticipated, will give a speed of 25 knots, and she will have capacity for 450 tons of coal and oil fuel. The new vessel, which is to cost £350,000, was at first intended to have been of the same dimensions as the *Boadicea*, but after preparations had been made for laying her down, the Admiralty, as I said last month, directed that her beam was to be increased so as to give an additional displacement of fifty tons with the same draught. A large quantity of material is ready, and fairly rapid progress may be expected; indeed, she should be launched, all being well, at the end of the year. It is interesting to note that she is the two hundred and forty-second vessel laid down at this yard. It has been stated that the vessel, is to be named the *Caractacus*, but this is merely conjecture, for no name has yet been officially announced. With regard to the *Boadicea*, a constructive officer from the Admiralty was engaged at the beginning of the month checking the weights of all loose materials and objects on board not forming part of the hull proper, so as to ascertain the cause of an apparent discrepancy between the actual draught of water of the ship and the draught as calculated by the designer's staff. Excellent progress has been made in shipping the machinery, all the turbines and most of the auxiliary machinery in the after engine-room being now in place. The *Boadicea* is the first ship to be built at this yard to be fitted with turbines. The electrical installation will be put in hand very shortly, and it will be carried out on the principle adopted in the *Defence*. That vessel, by the way, was to have left on June 15th for Devonport to be docked preparatory to the official steam trial. Her departure, however, has been postponed until July 28th owing to the impossibility of providing a navigating party before that date. On June 10th, seventy-two casual labourers employed under the naval store officer in coaling the *Defence* struck work and dockyard labourers regularly employed on ship construction under the chief constructor had to be requisitioned. The cruiser *Medusa* has arrived to be fitted as a depot ship in calibration tests at Bantry. An electrical installation, mainly for lighting purposes, is to be fitted to the vessel after the *Defence* leaves. The *Medusa* is to have her engines taken out, so she will be merely a hull when completed and will have to be towed to her destination. She will, however, be fitted with two boilers for driving the dynamos. The destroyer *Greyhound* has arrived from Devonport for a refit. She has been sent here by the Admiralty as the result of a decision arrived at in February, ... to provide sufficient work to keep all the men at the yard fully employed during the absence of the *Defence*. I have previously referred to Pembroke's economical shipbuilding. With regard to this, an Admiralty minute expressing appreciation of the fact that the cruiser *Warrior* was built for less than the estimated cost, and was the cheapest ship of her class, and complimenting the officers and workmen who had contributed to bring about that result, has been received here. The *Warrior* cost £1,186,395, while the average cost of her three sisters, which were built by contract, was £1,200,822. "My Lords" may now possibly show their further appreciation by sending us enough work to keep us fully employed.

VISIT TO BURNT MILL WORKS—MESSRS. JOHN KIRKALDY, LIMITED.

The River Lee is one of the northern tributaries of the Thames, rising about three miles north-west of the town of Luton, and after a winding course of about 70 miles, with a fall of about 400 feet, it joins the Thames by Bow Creek; from the Lee and its neighbourhood, the main supply of the water for the New River and East London Water Companies are drawn.

The river is of great antiquity; history tells us that the Danes sailed up the stream, spoiling the dwellers on its banks, and King Alfred visited Ware, one of its towns, by water.

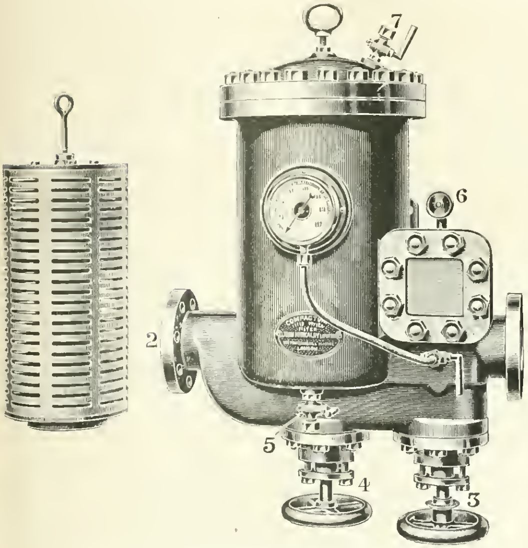


"Compactum" Patent Fresh-Water Distiller

The river Stort, one of the Lee's main tributaries, joins the Lee at Fieldes Weir, near Hoddesdon; it rises a little above Elsenham and was made a navigable river about the year 1761.

Our journey to the works of Messrs. Kirkaldy, at Burnt Mill, takes us along the valley through which these rivers flow, past the Enfield Lock Small Arms Factory, Waltham Abbey and Cross, renowned in Queen Eleanor's time, and now the centre of the Government smokeless-powder factories,

near Broxbourne, with its pretty neighbourhood, where we get a good view of the river. The Crown gardens here are worth a visit; there is boating to be had and plenty of other

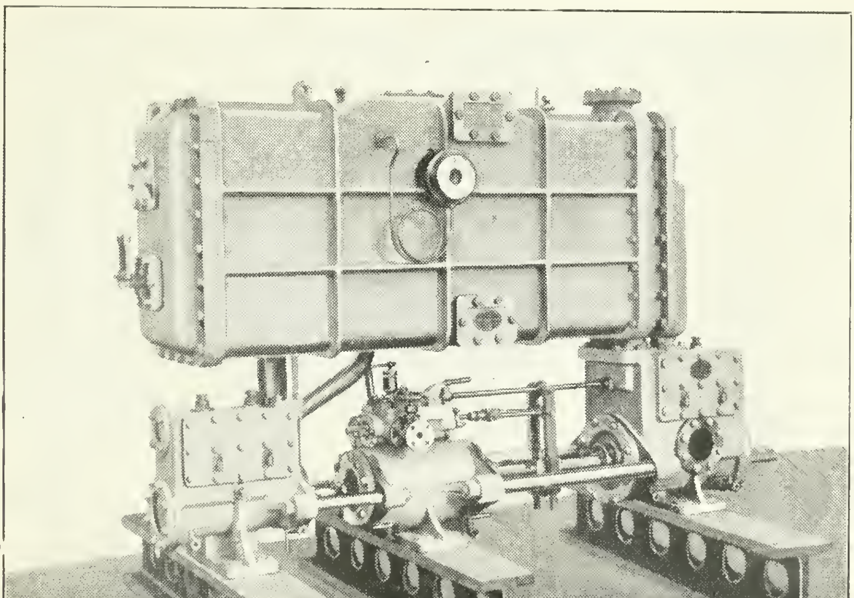


Right-Hand Filter with Cartridges.

amusements to pass away the time.

A little beyond we catch a glimpse of the dome of Haileybury College, the training place for so many of the old East India Company's great men, and still a very noted Public School. We can also see Rye House, now a place of holiday recreation, but when Islington was a village on the outskirts of London, it was a journey not so lightly to be undertaken to the scene where now we find ourselves on a Saturday afternoon with ease amid pleasant surroundings. The Rye House, with its memorials of other days, when King and Parliament were at variance and the inherited folly of the monarch was stimulated by the sycophant and the flatterer, while the ambition and self-interest of party leaders fostered enmity and strife, to the detriment of the public weal. From following a train of thought suggested by these reminiscences of times past, to a comparative view of current events and the possible judgment which may be passed by generations yet to come, we are brought in the course of our wanderings to within a short distance of the object of our journey, and we see before us the works whither we are bound. Situated amid fresh air and a country life, those who are employed here possess great advantages over those who have to pass through crowded streets or endure the other discomforts attached to going to and from town workshops, breathing an atmosphere charged with unpleasing odours and smuts. It was a good move when the firm removed their works from the neighbourhood of the docks, where first we made acquaintance with their specialities some twenty-six years ago.

This firm has a wide reputation as makers of all kinds of engine-room auxiliaries, notably the fresh-water condensers, familiar in the engine rooms of our steamers; these are made to suit all pressures and although the first of the type was fitted as long ago as 1873, connecting us with the old sailing, transport and emigrant days, the advance in pressure of steam and the more exacting requirements of to-day are met by the advance in excellence of material and workmanship The Compactum Condenser justifies its name. A look around the workshops shows that all are placed very conveniently for expeditiously handling their manufactures, and consist of the usual executive and drawing offices, pattern shop, stores and tool and gauge rooms, foundries, smithy, boiler and coppersmiths' shops, turning and fitting shops and testing shops. We see under construction some of the firm's specialities, such as evaporators, feed heaters, feed-water filters, distilling condensers, boiler feed pumps, ballast



The "Compactum" Surface Condenser and Pump.

pumps, winch condensers, air and circulating pumps, distilling plants for war vessels, all of which are more or less familiar to marine engineers. Some very high-class examples of the distilling plant are in hand, both for our own and foreign Governments, and anyone who can look back for even such a short space of time as twenty years can note the great advance that has been made in marine auxiliaries, all necessitated by the increased boiler pressures and all tending to economy of fuel and the prolonged economical life of boilers and engines.

The illustrations show the Compactum Fresh-Water Condenser and the Feed-Water Filter, also the coils which comprise the steam and fresh-water carriers with the outer surface exposed to the circulating cooling water in the condenser, and the grids with the perforations through which the feed water passes to the filtering media in the feed-water filter; the other illustration shows the auxiliary surface condenser with air and circulating pumps attached, as made by this firm. Most of the modern-built steamers are now fitted with an auxiliary condenser to deal with the steam used in port for winches and other auxiliaries and for this purpose it is a valuable adjunct to the engine room for economy.

ELECTRICITY ON BOARD SHIP.

XVIII.*

By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc. M.I.C.E., etc.

The Incandescent Electric Lamp.

THE incandescent electric lamp depends for its operation upon the fact that whenever a current of electricity passes through any substance, and in particular any conductor, heat is liberated in the conductor, in proportion to the square of the current strength and also in proportion to the resistance of the conductor. The heat liberated also depends directly upon the square of the pressure applied to the terminals of the conductor, and inversely upon the resistance. Up till very recently the light-giving portion of all electric incandescent lamps was made of a very fine thread or filament, as it is called, of pure carbon. During the last few years, however, the metallic filament lamp has been invented, and is assuming a very practical form. The metallic filament lamp is really a return to the earlier forms of incandescent lamp. In the very early days of electric lighting, when the problem of the division of the electric light was exercising the minds of scientists, many attempts were made, by Mr. Edison in particular, to employ platinum for the filament. But platinum was found to be not sufficiently refractory. When a current passed through it, of sufficient strength to cause it to furnish a light, the platinum melted. Mr. Edison arranged several devices to switch off the current before the filament broke and immediately to switch it on again, but they were not successful, and inventors turned their attention to the more refractory substance, carbon. In recent years, however, what are called the rare metals, Tantalum, Tungsten, Osmium, Wolfram and others, which possess the two necessary qualifications for the filaments of incandescent lamps, *viz.*, high resistance and very high melting point, have been pressed into service. Lamps are now on the market, whose filaments are made of very fine wires of the metal Tantalum alone, the metal Osmium alone, the metal Tungsten alone and of alloys of Tungsten, Osmium and Wolfram. The last named is known as the Osram lamp. So far the metallic filament lamps have only been made for low pressures, up to 130 volts, a few lamps of high C.P. being made for 200 and 220 volts. On shore this is a somewhat serious drawback, because the pressures in all the town electricity generating stations were increased a few years ago, from 100 and 110 volts to 200 to 260 volts, the object being to increase the area over which economical distribution of current could be obtained. On board ship, however where up to the present pressures of only 100 volts have been employed, the metallic filament lamps should be of great service because, as explained below, they furnish any given amount of light, with a very much smaller current than the carbon filament lamp. The best of the metallic filament lamps require about one-third of the current required by the usual carbon filament lamp, with the same pressure.

The Carbon Filament Lamp.

In the early days of electric lighting, carbon filaments were made in a great variety of ways. Edison, for instance, employed bamboo, which he deprived of all matters other than carbon. Swan employed cotton, which he treated by a method which is practically that employed at the present day, with certain modifications. Maxim employed Bristol board, his filaments being punched out of the board and then carbonized. Other makers used other forms. At the present day the manufacture of carbon filaments has settled down to practically one system. Cellulose, a pasty mass, which is present in many substances, such as cotton, linen, etc., is squirted through a die in the same manner as carbon rods are, and very much in the same way as wire is drawn. In fact, the process is very similar to wire drawing, and the result is the production of a coil of cellulose wire immersed in a bath of alcohol. The coil of cellulose is drawn to a certain gauge, according to the pressure for which the lamps the filament is to supply are to work with. Low-pressure lamps have much thicker filaments than high-pressure. Doubling the pressure of the lamp approximately halves the sectional area of its filament for a given amount of light. Again, the sectional area of the carbon filament will depend upon the amount of light it is to give with a given pressure.

Thus, the filaments for 32-C.P. lamps of a given pressure have a larger sectional area than those for a 16-C.P., and those for 50-C.P. have a larger filament than those for 32-C.P., and so on. The filaments for the very high C.P. lamps, 200 C.P., 300 C.P. and so on, are more like twigs bent into the horse-shoe form that is required to place them in the lamps. It should be mentioned that carbon filament incandescent lamps are made up to 1000 C.P., but 500 C.P. lamps are practically as high as would be serviceable on board ship.

The cellulose wire is cut up into lengths, according to the C.P. and pressures of the lamps for which it is intended. Thus, the filament of a 16-C.P. lamp for 200 volts is a little more than double the length of the filament of a 10-C.P. lamp for 100 volts, and is approximately half the sectional area. The two factors in the filament are, it will be seen, the sectional area and the length. The sectional area increases with any given pressure with which the lamp is to work with the amount of light required, and the sectional area decreases, while the length increases with any given amount of light as the pressure increases. In practice, as thousands of lamps of the same pressure and the same C.P. are turned out daily, one machine will be turning out cellulose wire for lamps of a given pressure and a given amount of light, another machine will be turning out cellulose wire for lamps of the same pressure, and another C.P., and so on. After the wire is cut up into the lengths mentioned—the filaments, as they have now become, are placed on charcoal formers, on which they are made to assume exactly the form they will take in the lamp, and they are placed in a furnace, and all the material burned away from them except carbon itself. When removed from the furnace they are pure carbon, but in a skeleton form. They are then attached to the platinum wires, which are to lead the current to them when in use as lamps placed in the globes with which everyone is familiar, and the partially finished lamp connected to a current of electricity, while the globe is connected to, first a supply of coal gas, and then a vacuum pump. The point of the lamp globe, with which everyone is familiar, when the lamp is being made has a small tube attached to it, formed with the globe by the glass blower. A number of the lamps with their skeleton filaments are fixed in a frame, and the tubes from the globes connected to the supply of coal gas, the gas being allowed to fill the globes, and at the same time a current of electricity being allowed to pass through the lamps. The heat liberated by the current in the filament decomposes the coal gas, the carbon which is one of its components being deposited in the cracks and pores of the skeleton filament and gradually building it up into the form with which everyone is familiar. The attendants know when the filament has been built up sufficiently

* For Articles I. to XVII., see previous issues.

by its appearance. When it is first connected to the supply of gas and a current of a given pressure is allowed to pass through the filament, the heat liberated is very small, because the resistance of the filament is so high. As the deposit of carbon goes on, however, the body of the filament being gradually built up its resistance decreases, more current passes through it and the heat developed and the light given gradually increase. When the building-up process is complete, the gas is shut off, and the lamps are connected to a vacuum pump, the current still passing through the filaments, and the gas and air are abstracted from the globes till a very high vacuum is obtained, only a very small fraction of air remaining in them. The small tubes are then sealed off, at what becomes the point of the globes, by means of a blow pipe flame, and the lamp is complete, ready for capping.

The Platinum Wires.

The platinum wires are used for connecting the filaments to the wires outside of the lamp, because platinum expands at practically the same rate as glass, and therefore no capillary space is left between the platinum and the glass, when the lamp is hot. When current is passing through the lamps they are very hot indeed, and unless the metal which passed through the glass to connect to the carbon filament expanded at the same rate as the glass, the vacuum would very quickly be lost. Quite recently a new process has been introduced, in which a copper wire covered with enamel is employed in place of platinum. The great object of this method is to reduce the cost of the manufacture of the lamp, the enamelled copper wire costing much less than the platinum wires it displaces. Platinum wires are employed with all sizes of carbon filament incandescent lamps, and also with the metallic filament lamps, the co-efficient of expansion of the metals used for metallic filaments not being the same as that of glass. In the very high C.P. carbon filament lamps it is usual to employ several platinum wires, to connect to the carbon filament, while with the lower C.Powers, only one wire is employed, and its outer end is connected to the lamp cap, as will be explained later.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

Electrical Advantages in Machine Shops.

IT will resolve itself in these days into a question of cost if electric driving supersedes shafting, and it therefore makes us ask what are the points which determine a change. Power is generally about 10% of the finished cost, and a saving of 50% gives 5% on the total, which is worth consideration. There is, however, the cost of manipulation and the increased production of electrically driven tools to be thought of. The question as to source of power is important and if the owner has his own power, it will obviously pay better than if derived from outside source. Motors are, like other machines, better if too large than the reverse, so that if a strain is thrown on there is not the same liability of breakdown from a burn-out. As regards driving the system of grouping is probably the best, a line of shafting being employed with separate motors for heavy tools, a variable speed motor should be employed with machines not engaged in repetition work as being more economical. It will be seen, therefore, that each individual machine has to be separately considered as to utility of separate drive and the class of motor to be used, and then proper grouping of the remainder will be likely to ensure the best results.

Metallic Lamps.

It is well-known that the ordinary carbon filament lamp is practically superseded by the new metallics. The decrease in running costs accounts for this, or what is the same thing the extra light given. There are naturally difficulties in the way of a general adoption of the principle, first cost being one, another is the not being able easily to obtain a low power, which has led to all sorts of devices being adopted. There is apparently no limit to the number of these types of lamp, several leading firms having a lamp to put forward. In one case it is claimed that 1000 hours is the burning life. The filament being metallic will stand rough handling, still breakages in transit are common and special precautions have to be taken in carriage. The lamp, however, is not so suitable for direct current as for alternating, and therefore a form of transformer is necessary. Allowing, however, for drawbacks, such as those mentioned, it has been fonnd that the life of the new lamp is three or four times that of the carbon filament type. The cost of renewals is said, therefore, under these circumstances to be about equal at present prices, but it may be fairly assumed that a new era has set in in this direction, and that greater improvements will follow.

Crane Controllers.

In referring on different occasions in this column to the utility of electrically-driven cranes for dock or ship use, we have briefly noticed the application of the controller which is so important an adjunct of the system, and without which the various operations are scarcely possible. These controllers are of the drum type and designed for use with cranes, hoists, winches, gun turrets, and wherever the load is intermittent and varying. For a crane the usual method is that when the load is lowered it drives the motor, which then acts as a generator. This allows light or heavy loads to be lowered gently or quickly and without strain on the gearing, the current produced in the operation being absorbed in a resistance which can readily be varied to obtain different speeds. By this plan, too, a simple holding brake is all that is necessary to hold the load steady in any position, and the cost of a mechanical brake is saved. As regards controllers for travelling they are arranged so that the motor when switched off and running by its own momentum acts as a generator, short-circuited, across a variable resistance, thus doing away with a mechanical stopping brake. A feature of the system is that the braking positions are effective in both directions, a contact device automatically reversing the connections before the controller handle has reached the positions corresponding to the direction of travel. By this means also remote control is possible. There are other advantages, but we have probably said enough to show the importance of the matter.

Electric Pumping.

An important installation has recently been carried out for ship work by Messrs. Lawrence Scott & Co. of Norwich, for a Russian man-of-war, consisting of seven machines, each delivery 500 tons, and six with an output of 300 tons each. An important feature is that the centrifugal pumps are placed in the lowest part of the ship and the motors over the protected deck, where there is freedom from water. To do this vertical shafting is necessary, and this is made to be adjustable on ball bearings specially lubricated. Then the power taken by the shafting is very small. Up to 900 revolutions that required was as low as ·9 amps. at 100 volts. The firm's ship type of motor is employed, one special feature of which is the insulation which has stood very severe tests on service and never been known to fail. A 2000-volt alternating current test is employed on all parts in progress, and the method of impregnation is closely studied to obtain the best results. Many thousands horse-power has be n supplied by the firm for marine work.

"BARGES."—On June 6th there sailed from Chepstow for Pernambuco, the sailing barge *Manaos*, and on June 20th, a similar craft, *Para*; these have been built for Messrs. Wilson, Sons & Co., Ltd., by Edward Finch & Co., Ltd., Bridge Works, Chepstow, and were rigged so as to be sailed out to their destination. For the same owners and to the same place have been despatched lately two somewhat similar barges, but in loose parts, for putting together at Pernambuco.

WE understand that an order has been placed with Sir Raylton Dixon & Co., Ltd., of Middlesbrough, by Messrs. Parbury, Henty & Co., of London, the agents for the Colonial Sugar Refining Co., of Sydney, Australia, for a steamer on the builders' latest improved cantilever principle to carry 7,300 tons cargo, the top-side tanks being specially adapted for the carriage of molasses in bulk. The engines of 2,500 I.H.P. will be built by the North-Eastern Marine Engineering Co., Ltd., of Sunderland. The ship and her engines are being built to the specification and under the superintendence of Mr. J. Pickering, M.I. Mech. E., Glasgow.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

Naval Work. To the very small amount of naval work on hand in Clyde establishments for the British Admiralty, one or two fresh items fall to be recorded. At Messrs. John Brown and Co., Clydebank, work is now proceeding with the construction of a powerful tug for the Admiralty, the order for which was placed about the end of May. Apart from this small vessel and the torpedo destroyers still on the stocks at the yard of Messrs. William Denny & Brothers, Dumbarton, there are no naval contracts being executed in Clyde yards for the British Admiralty. In the new yard of Messrs. Yarrow & Co., at Scotstoun, of course, as noted in our April issue, a number of torpedo boat destroyers for the Brazilian Government are under progress. The armoured cruiser *Indomitable*, built by the Fairfield Company, has now been delivered, as elsewhere noted in this section, and the sister ship *Inflexible* built by the Clydebank firm is now passing through the final stages of her crucial speed and other tests. So far as constructional work is concerned, therefore, Clyde yards are, Oliver-like, asking for "More." Hopes are entertained that the turbines for the cruiser of the improved *Boadicea* type, now being laid down at Pembroke, may be given to some Clyde engineering establishment, but, from experience, Clyde employers and workmen alike are not given to build too much on expectation.

Fairfield Productions.— The Fairfield shipbuilding and Engineering Co., Govan, launched on the 27th ult. the twin-screw steamer *Princess Charlotte*, which they have built to the order of the Canadian Pacific Railway Company, for service between Vancouver and Seattle. Vessels from the Fairfield stocks are already serving in this Company's Atlantic Great Lakes services and when the steamer just launched is put on her station the Fairfield Company will be represented in all the waters on which the large Canadian railway line run steamships. The formal handing over of the new armoured cruiser *Indomitable* to the Admiralty about the 17th ult. marks the completion of another of those highly creditable naval contracts for which the great Govan establishment has long been renowned. The *Indomitable* was laid down early in 1906, so that she has been delivered well within two and a half years, including the additional work of completion ready for commission, which is now part of the Admiralty requirements. The work which has to be done after such a vessel has run steaming trials usually requires from three to four months, but the Fairfield staff carried out the whole work in the unprecedentedly short time of just over one month, thereby having the vessel ready for carrying H.R.H. The Prince of Wales to Quebec for the Canadian Tercentenary Celebrations, on which commission she is about to leave Portsmouth.

Longitudinal Method of Ship Construction. — Messrs. William Hamilton & Co., Shipbuilders, Port Glasgow, who have arranged, under licence from the patentee, for the construction of steamers on the "Isherwood" system—the invention of Mr. J. W. Isherwood of Messrs. R. Craggs & Son, Middlesbrough—have now, it is reported, secured their first contract for a steamer of the type. The vessel will be of large dimensions and will be the first to be built on the new system under Lloyd's rules for that society's highest class. In the Isherwood method of construction the closely-spaced transverse frames and beams of the ordinary type of merchant steamers are for the most part dispensed with, and transverse strength obtained by fitting directly on the shell plating a series of strong transverse girder frames and beams at widely spaced intervals. These transverse girders, wherever practicable extend completely round the hull, and are of sufficient strength to withstand the whole collective water pressure on the skin of the ship, and the upper portions are of such strength as to be able to carry the same collective weight on the deck as the greater number of beams fitted in ordinary vessels. Among other advantages claimed for the new system is that it requires very few pillars in the holds without necessitating increased strength elsewhere, that a vessel so constructed will not be so liable to be broached by collision, and that the cost of maintenance and repairs will be lower.

Shipyard Machine-Tools.—Messrs. James Bennie & Sons, Clyde Engine Works, Cardonald, have contracted, through Messrs. William Jacks & Co., Iron and Steel Export Merchants, 19, St. Vincent Place, Glasgow, to furnish the whole of the shipyard machinery required for an extensive new shipyard at present being laid down at Hamburg. Of the work at present on hand by this and other West of Scotland machine-tool-making firms, a fair proportion is to German and other Continental account. While German competition is more and more being felt in this country in regard to the rougher lines of manufacture, such as forgings and castings, it is gratifying to know that in finer directions, where long experience and well-tried skill are desiderata, British makers continue to hold the field.

Howden-Zoelly Turbines.—Messrs. James Howden & Co., Scotland Street, Glasgow, have recently secured the contract for a 6,000 horse-power turbine of the Zoelly type from the Corporation of Manchester, after keen competition by the principal steam turbine makers in this country and one on the Continent. Seven tenders were considered by the Corporation, four of which were for turbines of the Parsons' type and three of the Zoelly type. One of the tenderers for the latter type was Messrs. Escher, Wyss & Co., of which Mr. Zoelly, the patentee of the system, is the managing director. The giving of the contract to Messrs. Howden and Co. was largely due to the merits of the work already done by the firm in the building of turbines of this type. They have guaranteed a lower consumption of steam and have undertaken to deliver the Howden-Zoelly turbine in less time than any other maker. The contract includes the generator which is a Siemen's three-phase alternator, and the condensing plant which will be on the Contraflo patent. This 6,000 K.W. Zoelly turbine is larger than any other steam turbine installed in this country for generating electricity, with the exception of one of the same power of the Parsons type recently installed by the Manchester Corporation. The largest turbine of the Zoelly type at present at work in this country was made by Messrs. Howden & Co., and installed at the Powell-Duffryn Collieries, Aberaman, South Wales. This turbine, of 2,000 K.W. or 3,000 B.H.P., has proved so satisfactory in its working that the Powell-Duffryn Company some time ago gave Messrs. Howden a repeat order which they have now under construction. They have also secured an order from the Wimbledon Corporation for a turbine on this system of 1,000 K.W., and are besides engaged on another somewhat smaller turbine as part of an experiment which, if successful, should lead to highly important developments in one of the leading branches of engineering in this and other countries. Messrs. Howden and Co. are proceeding to greatly extend their works in Scotland Street to prepare for the rapid production of Howden-Zoelly turbines of all sizes.

New Docks at Aberdeen.—For the development of the fishing industry a scheme of additional dock accommodation is projected at Aberdeen. Mr. R. G. Nichol the engineer to the Harbour Commissioners at that port, proposes to construct four branch docks on the south bank of the River Dee on the lands of Torry, and also a wharf along the north bank in continuation of the wharf recently erected at Perint Law. The east-most part of the branch docks could be first proceeded with and the others could follow in succession as the demand for extension arose. The total area of water space and quayage provided for in the scheme is 37¼ acres. Each branch dock would be about 530 ft. long, with an average width of 320 ft., and would lie at an angle of 60 deg. to the centre line of the river so that vessels would have an easy entrance. It is likewise proposed by Mr. Nichol to straighten and deepen the berths at the wharf on the south side of the Albert Basin, involving a length of 1,555 ft. Altogether the scheme is estimated to cost £220,260, and the portions which the engineer recommends should first be proceeded with are the construction of branch dock No. 1 at the south side of the river and the wharfage at the north side at a total estimated cost of £49,880.

Glasgow Technical College.—To the splendid pile of buildings forming the new Technical College in George Street,

Glasgow, the foundation stone of which was laid by His Majesty the King almost five years ago, a third and completing section is shortly to be added—or at least proceeded with. The first section has been in use since December 1905, when the opening ceremony was performed by Mr. Sinclair, Secretary for Scotland, but notwithstanding the expedition of the contractors the second section of the general pile is not yet completed. To make way for the third and completing part, St. Paul's Parish Church has been purchased for £15,000 and will be demolished. The completing section of the buildings will cost £26,000, while £250,000 has already been expended on them.

THE TYNE.

(From our Own Correspondent.)

The Shipbuilding Dispute Ended.—The protracted shipbuilding strike on the Tyne and other Northern rivers has at last come to an end, and it is most unlikely that such another serious disruption of trade will take place for many years to come. A move towards the establishment of a permanent Conciliation Board for the industry has, in fact, already been made, and there is no reason to doubt that this most necessary institution will soon become an established fact. It will, of course, be necessary that a similar arrangement for the settlement of disputes in the marine engineering industry shall also be brought into existence, and steps towards this end will no doubt be taken as soon as the trouble in the engineering trade is settled. There need never be a strike again in either of these industries, after the establishment of these Boards, if one matter can be satisfactorily dealt with, namely, the method of appointing a final referee. Such an official—when needed—must have the confidence of both sides, and must have the qualities requisite to command that confidence. Years might elapse before the need for a referee might arise, and should such a contingency at any time occur it may be hoped that the Board of Trade will be able, if called upon, to deal with it.

The Engineering Trouble.—It was almost universally expected that when the shipbuilding strike was ended there would be little difficulty placed in the way of peace being restored in the kindred industry of marine engineering. At certain Tyneside centres, however, there appear to be recalcitrant spirits, who "love fighting for fighting's sake," and who do not appear to be greatly influenced by considration for others. These are the men—or a specimen of them—of whom the late General Secretary of the A.S.E. was so ashamed that he resigned his position in the society—an incident in reference to which there is little need for comment. That the members of the A.S.E. upon the Tyne are very much divided amongst themselves there is not the slightest reason to doubt. Some of them (the wiser portion) are anxious for returning to work on the employers' terms which, as is well known, involve a small reduction of the existing wage; some others are understood to be standing out for a withdrawal of the reduction claims; and another section are said to be considering a demand for an advance. It is to be hoped that this latter section constitutes but a very insignificant minority—otherwise the sanity of the engineers as a body may well become a subject for investigation. At the time of writing a meeting of engineers is being held in Newcastle in reference to the settlement of the question, and it is to be hoped that on this occasion the more sensible men will assert themselves and insist on this insensate policy of obstruction being brought to an end.

Empty Shipbuilding Berths.—A journey by river steamer from Newcastle to Shields reveals to the observer the disturbing fact that, out of some sixty berths constituting the building capacity of the dozen or more yards that are in operation, twenty-eight or nearly half the number, are without occupants. This, in conjunction with the equally depressing circumstance that there are over eighty well-equipped steamers "laid up" in the river and docks, creates a gloom which even the ending of the wood workers' strike has not served to lighten. The fact is that orders for new steamers are not to be had, and the state of slackness in this district would be even worse but for the fact that one well-known firm have succeeded in obtaining some orders for pontoon work. The Low Walker yard of Messrs. Armstrong, Whitworth & Co. appears to be less busy, one of the berths from which a vessel was launched several weeks ago being still vacant. At the company's Elswick establishment no appreciable diminution of briskness has become noticeable. Messrs. Dobson & Co. have launched a vessel lately, but have not yet placed another keel, and Messrs. Swan, Hunter and Wigham Richardson have launched a pontoon dock from their Wallsend yard. This firm have other pontoon docks in course of construction, and have also in hand some half-dozen steamers of a large class.

The Palmer Company.—With the exception of repair work to a battleship lying alongside the yard, and the finishing of a large vessel which was commenced early in the year, there are at present no important contracts in hand at the Palmer Company's yard, and the number of men employed is very far indeed from being up to the average. It is rumoured however that the company are in negotiation for work, and it is hoped that some of the berths that are at present unoccupied will shortly be brought into use. The work in hand at the Northumberland Shipbuilding Company's yard is less than at the commencement of the year; but the Tyne Iron Shipbuilding Company have three vessels on the stocks, and Messrs. Readhead have in addition to the new vessels in hand, two or three vessels under repair in the docks and at the quay. Messrs. Wood, Skinner & Co. have set on a good many joiners to complete the fittings of the passenger steamer which was launched from the yard some months ago, but has been detained through the labour dispute. The repairing facilities of the Tyne are at present by no means fully utilized, several of the larger docks being, as we notice, without occupants.

Engineering Work.—At the Wallsend Shipbuilding Company's works a large vessel is being fitted with her machinery, and another is expected to be placed under the shearlegs shortly. The North-Eastern Marine Engineering Company are also fitting the machinery in a vessel at the quay, and at the Neptune Works, Low Walker, an exceptionally large boat is being similarly equipped.

The steamship *Gleneske* which has been principally engaged in the Eastern trade is moored at the St. Peter's Engine Works for the purpose of a general overhaul of the machinery, and good progress has already been made with the work. Mr. Cleland, a slipway proprietor at Willington Quay, has patented a new type of gas suction plant, which is said to be a great improvement upon the older types, and is suitable for application to marine propulsion.

Manufacturers of auxiliary machinery for steamships have experienced a slight improvement in demand since the termination of the ship yards strike but the state of business is still unsatisfactory and it is not expected that any material improvement can take place until there is a recovery in shipbuilding. Steel works at Consett and Newburn are still very slack, but there appears to be a probability of new specifications being received, in which case greater scope for employment will be provided. In the iron foundries no change is to be noted.

THE WEAR.

(From our Own Correspondent.)

Shipbuilding.—The number of launches on the Wear during the first half of the year has been unprecedentedly small, but several vessels are now about ready for being put off the stocks, among them being one of exceptionally large dimensions which, it is understood, is intended for employment in the cattle trade. This fine vessel is being built by Messrs. J. L. Thompson & Sons to the order of local owners, for whom the firm have built many vessels of a superior class. Messrs. Blumer are preparing to launch a vessel, and the Sunderland Shipbuilding Company have also one nearly ready for leaving the stocks. Messrs. Austin have had a fair amount of repair work during the month, and both graving dock and pontoon have been kept pretty regularly occupied. Messrs. Doxford are understood to be short of orders and only part of their large shipbuilding works is kept in operation.

Slackness is the prevailing feature at all the other yards above the bridge. The North Hylton yard will soon have all its berths empty, as the only vessel on the stocks is being prepared for launching.

Engineering.—There is nothing new to report in connection with the state of business in the engineering works; but several vessels will be due for machinery equipment shortly, and at most of the works this will cause a temporary stir, with the result that a few more men will be employed. Owing to the arrival of some timber-laden ships there has been considerable activity at the Sunderland docks within the past few days, and much needed employment has been provided for a number of labourers. Other ships with timber are expected early in July.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

Since our last issue the Manchester Ship Canal and most of the Salford and Manchester docks have been completely deepened from 26 ft. to 28 ft. Those docks, or parts of docks, the deepening of which is not yet completed, will shortly be of the uniform depth of 28 ft. The deeper water will prove of greater advantage than many people imagine. It will enable large vessels to navigate the waterway which hitherto they have not been able to accomplish without discharging some of their cargo before entering the Eastham locks.

Marine Service Association.—At the annual meeting of the Mercantile Marine Service Association at Liverpool early in the month, a most favourable report was read, dealing with the numerous branches of work carried on by the association in the interests of ship captains and officers. Captain Trevery, the president, said a notable change had been the alteration in the attitude of the Board of Trade, which, from being a powerful enemy, was now recognised and appreciated as the best friend of the mariner.

Manchester Port Sanitary Authority.—The Manchester Port Sanitary Authority report that in a month's time 241 vessels were inspected at the port, an increase of forty-five as compared with the corresponding month last year. Notice has been given to have the steamship *Vareda*, only six months old, properly ventilated.

Liverpool Underwriters' Association.—The casualty returns of the Liverpool Underwriters' Association for May were above the average. Sixteen vessels, aggregating 43,852 tons, were totally lost. In May, 1907, however, twenty-two ships were last, but the total tonnage was only 39,916 tons. The partial losses were the heaviest for four years, numbering 412 as against 379 in May last year.

Captain Banner, deceased.—Captain W. Banner, a familiar figure associated with Manchester shipping, has been removed by death. Until lately he was pier master at the Duke's Dock, Liverpool, which was formerly owned by the Manchester Ship Canal. He had been in the employ of the Bridgewater Canal from his youth; he had served under its three designations—the Bridgewater Trustees, the Bridgewater Navigation Company, and the Ship Canal Company.

Salvage.—The Leyland-White Star liner, *Armenian*, for salvage services rendered to the s.s. *Manchester Trader* in mid-Atlantic, when on a voyage from Manchester to Philadelphia, the latter having lost her propeller on March 21st, has been awarded £3700 by the Court of Admiralty, the owners to receive £2950, the crew £500 and the master £250.

Meters, Limited.—The Meters, Limited, of Manchester, for their official year just closed, made a profit of £25,949, which allowed a dividend of 5 per cent.

Sea Water Corrosion.—In a paper read by Dr. J. Grossmann before the Manchester section of the Society of Chemical Industry, the reader stated that the addition of carbonate of lime to sea water does not render it non-corrosive; the addition of slacked lime, however, will stop corrosion caused by sea water at such temperatures as are used for its distillation. In this case an apparatus has to be used which prevents incrustation from taking place.

Power.—While opinions as to the relative merits of hydraulic as compared with electric power continue to be divided, the advantage of water power in case of fire is often overlooked. This has been practically demonstrated on more than one occasion at the Manchester docks, where the considerable pressure at the immediate disposal of the officials has enabled several fires to be extinguished even before the prompt arrival of the fire engines.

Employment in Mines.—The Government Mines Inspector for Manchester and Ireland district, in his report for 1907, says the number of persons employed in the 202 mines in North and East Lancashire was 45,935. Of these 36,031 were employed below ground and 9904 above. The last figures include 734 females. This was an increase on the previous year of 1415. The production of coal, which amounted to 12,136,667 tons, of the value of £5,482,739, showed an increase of 476,761 tons, the value of the coal raised being 14·28d. per ton greater. Miners had their wages increased 5 per cent. three times. In North and East Lancashire there were forty-nine fatal accidents, causing the death of fifty-eight persons.

Trafford Park Distress.—The distress prevailing in Trafford Park owing to the depression in the iron trade and the discharge of a number of superfluous workmen is still being relieved by the Distress Committee. At some of the larger works orders have come in enabling some of the "out-of-works" to be re-employed. The British Westinghouse Co. are also reported to have given work to a number of men they did not really require in order to minimise the distress. There is also a marked decline in the number of men required in loading and unloading vessels in the docks.

Iron and Steel.—The decline in the iron trade of the county shows very little improvement at present. Prices of raw metal and hæmatites have been receding for many weeks past, and the same is true, though less pronounced, in manufactured iron and steel. This last week some show of a stand against further weakness has been made, but it is not founded on the firmest of rocks. Tin and copper may be included in the same category. The depression is general. The North and the Midlands are in the same predicament. It is a case of "grin and bear it," and look hopefully to the future. The latest returns issued by the commercial department of the Board of Trade show that not only the United Kingdom, but also Belgium, France, Egypt, the United States, Canada and British South Africa experienced decreases during the first quarter of the year; increases of commerce, however, were recorded in Germany, Spain, Austria-Hungary, Japan, and British India.

The Lancashire coal trade remains steady for the moment, but the tendency is towards easier rates, especially to the larger contractors. Last year was a record period for the production and sale of coal at high rates, with increased wages for the miners to the tune of a total of 15 per cent. The workmen appear to be in league with their employers to this extent that they bring no more coal to the surface than will secure their wages.

The North Staffordshire Chamber of Commerce, at their meeting a few days ago, complained of preferential rates allowed for shipment of foreign goods as against English goods. An instance was given of English goods shipped from London at 35s. per ton for New Zealand, while, in the same vessel, goods from Hamburg were carried at 27s. 6d. Objection was also raised to the heavy postal rates imposed in this country on samples being 30 to 50 per cent. more than in Germany. In some cases the plan had been adopted of sending the bulk to Holland, and distributing from there. It was resolved to communicate with the Board of Trade and the Postmaster-General on the subject.

THAMES.

(*From our Own Correspondent.*)

The New Port of London Scheme.—As we have already intimated, this matter is referred to a Committee of both Houses of Parliament, which is taking evidence. The City Corporation is against dock purchase altogether as being injurious to the wharfingers and wharf owners. The question of new ports, too, is a thorny one to decide upon in view of foreign manufactured goods coming in free. Outside ports are against the Bill in some measure, arguing that London

shipowners should pay for their own lighting, instead of its coming out of the general lighthouse fund. The shipowners complain they are to be swamped in voting power, and all the big owners using the port are to get, as at present arranged, no more votes than small river craft. About casual labour, too, the owners complain that their action must be in no way fettered. Shipowners, as represented by the big companies, are evidently by no means satisfied at present. The Committee, of which Mr. Russell Rea is chairman, meet at Westminster Hall, and have already decided upon the principle of dock purchase. The general position reached is an outline embodying a possible new dock and various schemes of extension of present docks on both sides of the river. These works and interest allow for an expenditure of nearly five millions of capital. This is the Board of Trade view of what the new body is likely to undertake.

Company Meetings.—Since our last issue we have had meetings of the following important companies, and the issue of their reports—the Royal Mail, the Union Castle and the Orient lines. In the first case the fleet has increased considerably in the last five years. This is the line that is strengthening its position by entering fresh fields and tapping new sources of revenue. 2½ per cent. is paid on the ordinary stock after paying the usual preference dividend. The Union Castle line suffers from the depression in South Africa. Better times are prognosticated, a dividend on the ordinary shares being paid of 10s. per share. The Orient Co. reports prosperous conditions, and when their partnership with the Royal Mail Co. ceases they will have a fortnightly service to Australia alternating with that of the P. & O. Co. For this they have five new steamers to be delivered between the spring and autumn of next year, for which an extension of capital will be asked. The company, after paying the dividend on the preferred shares, pays 5 per cent. on the deferred, carrying forward £16,840.

Rotherhithe Tunnel.—This important work has been completed and was opened by the Prince of Wales, thus affording a means of communication between the Surrey Dock district and the Shadwell district on the north side. The situation is midway between the Tower Bridge and the Blackwall Tunnel. The total cost is two millions, but the advantage of such a tunnel is obvious. The total length from street to street is about a mile and a quarter. So perfect are the arrangements now for this class of construction that there has been no inlet of water into the tunnel and no serious accident. Some idea of the massiveness of the work may be gathered from the fact that 25,000 tons of cast iron has been used in the tunnel and 3500 tons of steel for stairways, etc.

Scientific Reports.—In this connection there has been the inauguration of a new Institute of Metals under the presidency of Sir W. White, which body is to undertake investigations into non-ferrous metals, that is, all those other than iron, which is under the supervision of the Iron and Steel Institute. It is said that the world's stock of iron ore is being used up so rapidly that a substitute will have to be found in the near future. Hence the Institute will have an abundant field for its energies.

The annual visitation has been made to the Greenwich Observatory, and many visitors attended on the only day in the year the public is admitted. The Astronomer Royal presented his annual report in due course. The yearly meeting of the City and Guilds Institute has been held at Mercers' Hall under the chairmanship of Lord Halsbury, who was re-elected to the position.

Sanitary Work in the Port.—The medical officer, in presenting his report, noticed the visit of inspection which is annually made by the Committee of the Corporation charged with this duty. The cost of protecting London's health in this direction is just over £10,000 for 1907, and, as is well known, all incoming vessels are boarded and hospitals provided for infectious cases. Besides this all food coming in is inspected and the whole cost is borne by the City, which controls this department through its committee.

The Yachting Season.—The weather recently has been most favourable for this pastime, and the Thames is said to have had one of the most favourable seasons on record. In the New Thames Yacht Club race Sir T. Lipton scored with the *Shamrock* and also was declared winner of the King's Cup in that of the Royal Thames Club. Another club race has been that of the Royal Corinthian, which was equally as successful as the others.

Sea-going Training for Sailors.—The Prince of Wales showed his approval of the system of training adopted for *Warspite* boys who have recently returned from Australia and rounded Cape Horn in the *Port Jackson* by inviting them to Marlborough House before they were dispersed for their holiday. General Moody and other members of the Marine Society were present to see the boys arrive, and it was a fitting termination to a successful trip that such notice should have been taken of them.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

The Outlook.—Although there have been no startling developments as regards the future prospects of trade in this district, there is a feeling of security amongst many interested in shipbuilding. One order has been booked for an ice-breaker for Canada, and this will find work for a large number of hands. This vessel is to be about 270 ft. long and have the abnormal breadth of 46 ft. In addition to being an ice-breaker she will have accommodation for passengers and cargo and her speed is to be 16 knots. She will be twin-screw, of course. This order was booked quite a month or more ago, but for certain reasons the news did not become public. This vessel is to be ready in nine months. Vickers are tendering for one or more of the proposed express steamers for the Fleetwood and Belfast service which are to be as large, if not larger, than the *Duke of Albany*, which was built by Browns, of the Clyde, a few months ago. Although the London and North-Western and the Lancashire and Yorkshire Railway Companies have already a fine fleet of steamers on this service, *viz.*, the *Duke of Albany*, *Duke of Connaught*, *Duke of Lancaster* and the *Duke of York*, they are determined to go in for more and probably one or two of the smaller ones will be transferred to the Lancashire and Yorkshire services on the East Coast, where the *Duke of Clarence* went. It is part of their scheme of competition with the Midland Company's service from Heysham, no doubt. The Barrow yard built the *Lancaster* and the *Connaught*, and it is hoped they will receive an order for one of the two proposed. It is known that the Admiralty are thinking of having constructed several floating docks for the submarine craft, but expense seems to be keeping the orders back. When they do give out an order Barrow should stand a good chance of getting it. They have built two small docks on Clark and Stansfield's principle lately. The Furness Railway are almost sure to want a new express steamer for the Fleetwood service for the next season, and Vickers will be sure to be asked to tender. It is not known whether she will have paddle turbine or reciprocating engines. The company have nibbled at a turbine, but did not come to any decision. The *Philomel*, which was purchased this year from the General Steam Navigation Co., of London, is now on the service, but she is not giving full satisfaction, and the importance of the service, which has grown considerably these few years, renders a new and fast boat absolutely necessary. There is also a rumour going that should the express turbine steamer *Ben-my-Chree*, building for the Isle of Man Steam Packet Co., prove successful, the company will place an order for another. Barrow should stand a very good chance of getting the order. The prospect of more naval orders is not so bright as one might wish. Not many orders are being placed at the present time, although there are some cruisers to be built shortly, for which all the important yards are tendering.

The "Rurik."—It would be interesting to know the reason for the many reports that have appeared in the press with respect to the trials of the Russian first-class cruiser *Rurik*, to the effect that serious defects were being discovered galore. The continental press has been full of these reports, and they have found their way into the British papers. There has been not a single official statement as to the trials of this vessel, and what has been published has been wide of the mark, to say the least. Certainly no war vessel has been built in England or Scotland under such conditions as has the *Rurik*. The methods of inspection are strange and difficult to understand, and the requirements of the Russian Admiralty in respect to the different departments and machinery are remarkable. There are many innovations and new fittings and there has been a great deal of changing.

The builders, we have every reason to understand, have met their customers in everything. To put it in a few words—if any builder can build a vessel for such an Admiralty under such conditions and pass her through her trials, then that same builder is fit to build anything on sea or land. The *Rurik* some time ago underwent her steam trials and more than satisfied the contract requirements. She did over 21 knots on a ten hours' trial. Since then she has undergone her gun trials and these have exceeded all expectations. Other trials of refrigerating and other auxiliary machinery have been satisfactorily passed, and the last steaming trial is being undergone at the time of writing. As far as the continent is concerned, there has been a great amount of jealousy in respect to this vessel, so one can understand the attacks, but why the British press should join in them is hard to understand. The official reports of the trials which will be out shortly, will set all doubts at rest and silence the croakers.

The "Vanguard."—Work is proceeding very satisfactorily on the *Vanguard*, the British "Dreadnought" of the *St. Vincent* class, and about September or October she will be launched. She will carry eight 12-in. guns there is no doubt. Her designs have been altered to some extent and this will make her a few hundred tons heavier, and these alterations gave rise to the rumour of her carrying 13·5 guns. Guns of that size will be used on a battleship of much larger dimensions than the *Vanguard* and her sister ships. There seems to be little doubt that she will be completed within the contract time, which is two years. That is, of course, providing that there are no more trade disputes.

The "St. Paola."—Work on the Brazilian battleship proceeds slowly, but perhaps a little faster than it has in the past, and this vessel will not be long after the *Vanguard* in launching. They are nearly the same size, but the British is turbine-driven while the Brazilian is twin screw-reciprocating engines. It will be interesting to see the results of these two vessels and compare power, coal consumption and speed. It was at first stated that this vessel would carry twelve 12-in. guns mounted four in two barbettes forward and the same number similarly mounted aft and a barbette on each side carrying two each. Now the news comes from a good source that she will carry 13·5 guns. Certainly 13·5 in. guns are being built for some vessel or other, but it comes as a surprise to hear that they are intended for the Brazilian. Time will tell. If they are 13·5 in. there is not much likelihood of there being twelve. At the most it will be eight.

The "Rathmore."—The London and North-Western Railway express steamer *Rathmore* has been finished and has left to run her trials. This splendidly fitted and built vessel is expected to exceed her contract of 20 knots with ease. She will prove an admirable boat for this company's Irish service, especially now that the Kingston route is at their mercy. The lock out caused a delay of a week or two in delivery.

The "Ben-my-Chree."—During the past month work has been put in on the Isle of Man turbine 24-knotter at high pressure. The lock-out set this vessel back a month or so, but since the men went in an army of joiners and shipwrights have been engaged upon her. She should prove a magnificent ship for the Liverpool and Douglas service. She differs considerably from the turbine *Viking*, which was built on the Tyne by Armstrong's. Apart from being larger in every way the arrangement of cabins is different. The saloon, instead of being aft, is forward of the boilers. This is no doubt done with a view of escaping vibration, which is a serious matter in connection with turbine vessels. There has been an elaborate scheme of stiffening the vessel with a view to overcoming the vibration difficulty, and the builders are pretty confident that they will stop the most of it. In appearance the *Ben-my-Chree* is bold to a degree. She possesses remarkably roomy saloons while her main and upper decks are surprisingly large and well sheltered. These will be wanted when she carries her full complement of passengers, *viz.*, 2500. She will be a popular boat. It is understood that she will leave the docks at Barrow for the Clyde about July 4th to undergo her trials, and some sensational speeds are promised. It would not be surprising to hear that she has done 27 knots.

Submarines.—No more submarines have been launched during the month. The C16 or "46" left in the middle of the month accompanied by the destroyer *Lightning*, and there is only the C18 left to be delivered to the Admiralty, and then come the D's, which are an entirely new class and practically only in an experimental stage yet. Two other submarines are fitting out at the wharf. It is impossible to tell how the D1 is progressing, for she is too secretly guarded. She is on the gridiron and on all sides is guarded by a lofty barricading. All interested in this new vessel are impatiently awaiting her completion and following trials, which are to be of a thorough description.

The New "Dreadnought."—During the month there was an important report from Portsmouth to the effect that when the *St. Vincent* was launched her place would be taken by the keel of a new monster "Dreadnought," which was to carry 13·5 in. guns and be driven by gas engines, the gas being made on board. The first part of the report was not surprising, but the gas engine story was out of it. Mr. McKechnie, the engineering director at Vickers, Barrow, read a paper on this class of engine some time ago and it caused much remark. Since then Beardmore's, on the Clyde, have been experimenting with a gas-engine-driven vessel. The results were satisfactory as far as they went, but they did not go far enough to merit their being put into a huge battleship which will require close upon 50,000 i.h.p. There may be a future for this class of engine, probably there is, but before the Admiralty use them they will have to prove more than they have at present, and even then they will not be put straight into a battleship. They will have to work their way up like the turbine. That will take some considerable time—years.

"General Guerrero."—The Mexican transport-cruiser *General Guerrero* is about ready, and will proceed to take her trials. She has been delayed by her guns not being delivered. These have arrived—they are not Vickers—and have been mounted. This vessel practically constitutes Mexico's navy. She will be handy for many duties. She has a cruiser-like appearance, but on account of her transport duties she has a big beam. She looks smart in her white paint and the Mexican eagle with a serpent in its beak in gold prominent on her bow. She is not a fast vessel, her speed being about 13 knots.

Gun Mountings.—There is a slackness in the large gun-mounting department at Barrow. The last cargo went at the end of last month (June). It is not known what there is in the way of orders in hand or in prospect, but it is to be hoped that there will be something to keep the men in. Perhaps the Spanish work may lead to Barrow being busier, for it is certain in Spain cannot tackle guns or mountings or armour. The sooner Barrow gets some of the work the better.

West Coast Hæmatite.—There is very little doing in the hæmatite iron trade, and works are only doing about half as much as they do when business is anything like brisk. Mixed numbers are nominally quoted at 60s. per ton net f.o.b., while warrants are about 58s. 7½d. per ton net cash settlement. The Barrow steel works, with the exception of the hoop department, are idle and are likely to remain so for several months. Small orders for rails are ocasionally booked by the West Cumberland makers. There is likely to be an improved demand for shipbuilding material in a few months, for the situation of Barrow is favourable to Belfast, and it is understood that at the latter place shipbuilding in a few months is likely to be brisk. When the gas-blowing plant is completed at Barrow they will be in a much better position to quote and consequently there is a chance of the works being more regularly employed.

Shipping.—The shipping trade is very dull indeed. The shipments of iron and steel have this year shown heavy decreases as compared with last year. This year's aggregate as compared with the total for the corresponding period of 1907, shows a falling off of nearly 170,000 tons. These are very startling figures, and show the inactive state of the iron and steel trade of the district.

SOUTHAMPTON.

(*From our Own Correspondent.*)

The "St. Paul" came out of dry dock on Tuesday, the 16th June last, and sailed for New York on Saturday, the 20th. As reported in our last issue, the vessel was in collision with H.M.S. *Gladiator* on April 25th last. Messrs. Harland and Wolff finished the work of repair well within the contract time and whilst the vessel was in dock both propeller shafts were drawn and the vessel underwent a general overhaul,

after which she was painted, and on leaving the dock looked very clean. She had practically a new stem bar fitted, which was a very large casting. Work proceeded day and night and there was not the slightest hitch in this extensive repair job, which is eloquent testimony of the efficiency of Messrs. Harland & Wolff's Southampton works.

The "Rotterdam." The heaviest vessel in the world, the Holland American liner *Rotterdam*, was dry docked in the Prince of Wales Dock during last month, previous to sailing on her maiden voyage to New York. Her immense size attracted numerous visitors to see the vessel on the blocks.

New Dry Dock.—A rumour has gained currency that a new dry dock, much larger than the Trafalgar Dry Dock, which is 875 feet long, is about to be constructed here, the site being near the Trafalgar Dock. The present dock is somewhat limited in width and according to rumour, the proposed dock is to be much wider in order to allow more room for bottom repairs, etc. That a pressing need for more dry dock accommodation exists cannot be doubted.

By arrangement with Messrs. Harland & Wolff, the upper floor of their extensive boiler-shop has been converted into an up-to-date electrically driven laundry for the White Star and American Line Steamship Cos. It was found necessary to erect a boiler house outside the steel building of the boiler shop and this is now nearing completion. A large return tube marine type boiler has been erected. A feature of this boiler is that the products of combustion, after traversing the tubes to the front of the boiler, are led back again to the middle of the boiler and then drop down the sides to a central flue and thence to the large red brick chimney.

The laundry machinery has been supplied by Messrs. Thomas Bradford & Co., of London and Manchester. The site of the laundry is conveniently near the present berths of the vessels and when the new wet dock is completed and the vessels take up their new berths, the distance will be materially decreased. The laundry machinery will be electrically driven throughout and will be capable of dealing with 100,000 pieces of linen per week.

The "Bengore Head," one of the Head Line cargo vessels owned by the Ulster S.S. Co., was repaired by Messrs. Harland and Wolff last month. The vessel was in collision and grounded twice whilst leaving Portsmouth Harbour on June 13th last. She was very light at the time and was caught by the high wind and tide and got quite unmanageable. She narrowly escaped collision with H.M.S. *Revenge*, and then headed bow on for H.M.S. *Vengeance*, which was coaling and crashed into the latter battleship's port side, shearing off the torpedo booms and net defence shelves, etc. The cargo vessel suffered severely. She then drifted on and fouled the moorings and when clear of the narrow channel grounded and was eventually towed clear by the harbour tug *Malta*. On arrival here she was dry docked for survey and repair, two plates on the starboard bow, third strake below sheer strake and just above the water line were renewed and started seams re-riveted. On the port side forward, just at the turn of the bilge, the vessel was badly holed and two plates were renewed here. Several frames were also straightened and and tank knees renewed. The port bilge keel was torn away for a considerable length, the damaged part was renewed. Whilst in dock the rudder was lifted and new pintles fitted. The *Bengore Head* was built in 1884 by A. & J. Inglis, Glasgow, and has a gross tonnage of 2,490 tons.

Messrs. Day, Summers & Co., Ltd.—The steamship *Emily*, recently built for the Rio de Janeiro Lighterage Co., is now having a large salvage pump fitted on board and as soon as this is ready she will go out for her official trials. The T.S.T. *Hercules* (owners, the Channel Coaling Co.), has been hauled up on the patent slip for survey; she will in all probability be sold, in which case certain structural alterations will be made to make her suitable for service in a tropical climate. The firm has just booked an order for a 600-ton patent hauling up slipway for the Milford Docks Co. We intend to illustrate this machinery in a subsequent issue.

John I. Thornycroft & Co., Ltd.—The *Amazon* 33-knot ocean-going destroyer—will be launched, with boilers and machinery aboard, in the course of a few weeks, her internal work also being in an advanced stage.

The *Nubian*—a 33-knot destroyer similar to *Amazon*—is on the stocks, and the work is progressing.

First-class torpedo boat No. 19 has completed her official trials very satisfactorily—the contract speed being exceeded—and was handed over early in this month.

Torpedo Boat No. 20 has completed her preliminary trials, and is now ready for her official runs. She will be completed for sea and handed over within a few weeks.

Two other first-class torpedo boats for the British Admiralty (Nos. 31 and 32) are both in an advanced condition, and will take the water in the course of the next two months.

All the above-mentioned vessels are adapted to burn oil fuel and their turbine machinery has been, or is being, constructed at the firm's Southampton works. In future, it is intended to construct all boilers at these works, the shops and plant having been removed from Chiswick for this purpose.

On the commercial side, among other vessels under construction there are five cargo steamers destined for services in South America; these vessels are 220 feet long and capable of carrying 700 tons of cargo each.

The s.s. *Lady of the Lake*—a twin-screw passenger steamer—has just been re-erected on the Lake Coniston (after having been constructed at these works and then dismantled and transported). She is now running in the Lake service of the Furness Railway. Her dimensions are, length, 90 ft, beam 15 ft., depth 8 ft. 9 in., draught 4 ft. 8 in., speed 11 knots. The vessel has accommodation for over 300 passengers on deck and in saloons. The machinery is placed aft, the second-class saloon amidships and the first-class forward. The saloons are panelled in polished hard woods, the settees in the first-class saloon are covered with frieze velvet. In both saloons, spring roller blinds of tapestry are fitted to all the windows, which are of rectangular form. The floors are covered with a special pattern of inlaid linoleum with a handsome border. Runners of Brussels carpet are supplied in the first-class saloon. On the upper deck sparred tramway seats are provided, some of which are made buoyant. The vessel has been built to Board of Trade requirements throughout. The machinery consists of two sets of high-pressure engines exhausting up the funnel, and the boiler is of the locomotive type. Speed trials were made on the lake and the contract speed considerably exceeded.

HULL.

(*From our Own Correspondent.*)

General Trade Report.—Several grain steamers have arrived from different parts of East India, also timber lading vessels from the Baltic, which keeps this class of labour very well employed. Steamers are also loading for the River Plate, Mexican, Japan and Indian Ports, in addition to the regular weekly traders to the Continent Ports. All steamers are securing prompt turns both at the coal hoists and at the dry docks, they are pretty well kept dry with the number of vessels going in, but still this port could do with very much more shipping trade than it has at the present time.

Earle's Shipbuilding and Engineering Company,—we understand have received orders for one or two more cargo steamers, and with what new work they have in hand will make them fairly busy in that department, but they have one or two berths remaining empty. In the repairing work they are very busy; they have in hand for Messrs. Cockerline and Co., one of their steamers with large repairs to this vessel's bottom.

Messrs. Amos & Smith still continue to receive orders for new machinery, and are also fully employed in repair work.

Cooper & Co. are exceptionally busy in ship and engine repair work, and are also working overtime in the foundry.

The Hull Central Dry Dock & Engineering Company.—The Company is very busy with repairs, they have an advantage over other engineering firms when it comes to dry-docking, as they have their own dock which will admit of vessels 350 ft. long by 49 ft. beam, and their dock charges are reasonable.

BELFAST.

(*From our Own Correspondent.*)

Messrs. Harland & Wolff.—This firm's yards are fairly well occupied with work, but since the departure of the Holland American liner *Rotterdam*, and the Aberdeen liner *Pericles*, they have not had a single vessel in the water.

This is a state of affairs which has probably been unknown within the last twenty years. However, before these notes are in print, the Red Star twin-screw steamer *Lapland* will have been launched from the north end of the Queen's Island, and two other vessels will be ready for putting in the water within a month or so of the launch of the *Lapland*. The *Pericles* above referred to is the largest and finest vessel owned by the Aberdeen line, being about 500 feet long by 62 feet beam, and having a gross tonnage of about 12,000. Full particulars of the *Rotterdam*, which left Belfast on 3rd June, have already appeared in *The Marine Engineer*.

Messrs. Workman, Clark & Co. are said to have received one or two important orders recently, and several other contracts are all but fixed up with this firm. At the end of May the twin-screw steamer *Verona*, built by them for the Societa di Navigazione a Vapore Italia of Genoa, underwent a series of speed trials on the Clyde. The *Verona* is a vessel of 500 feet in length, and is a sister ship of the *Ancona*, recently constructed by the same builders for these owners. In the case of the *Ancona*, a continuous twenty-four hours' run for determining the speed, and a cruise at fourteen knots extending over a similar period for the purpose of ascertaining the coal consumption were so highly satisfactory that it was not considered necessary to repeat these trials with the *Verona*. Messrs. Workman, Clark & Co. are at present engaged in the carrying out of extensive damage repairs to the London steamer *Auricula*. The order was secured in competition with the Bristol Channel repairing firms and others.

Messrs. Maccoll & Co. have the Newry steamer *Killeary* in graving dock for damage repairs to her bottom and stem.

JUNIOR ENGINEERS.

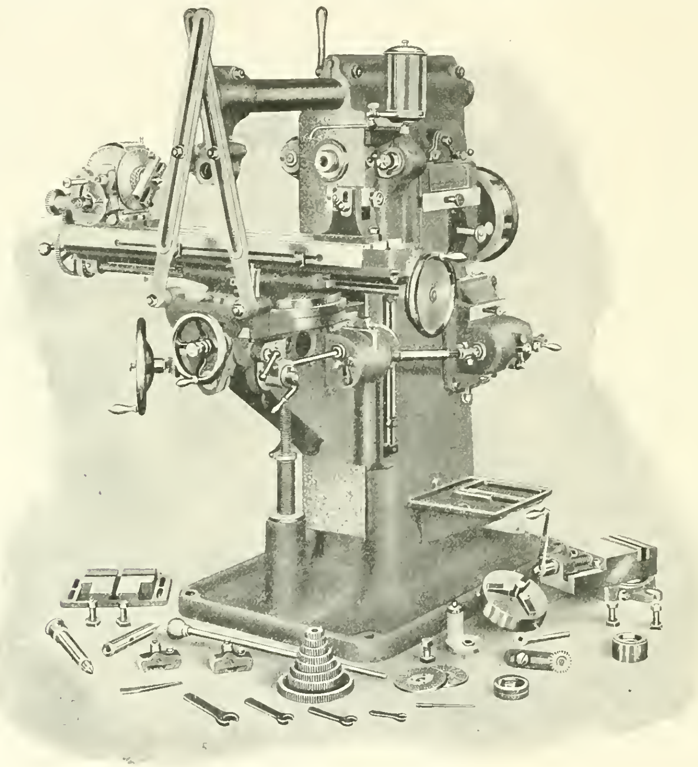
XXI.*

Milling Machines.

THE first illustration is of the Brown & Sharpe Universal Milling Machine, which is typical of modern practice in the lighter class of these tools.

The main drive is through the single pulley seen at the back of the machine; there being no stepped cone employed, the variations required in spindle speeds are effected by means of internal gearing. The spindle speeds are tabulated on the upper plate on the right-hand side of the machine, and the changes are made by first releasing and lowering the locking pin in the vertical slot below the plate, the index slide is then moved along till it corresponds with the necessary speed column, when the lower pin is again moved upwards as far as it will go, thus engaging the correct gears. The small crank above the plate doubles the number of speed changes, giving a fast and slow series by means of back gear.

The rates of feed are operated through the change box on the right. The feeds are tabulated on the plate attached to the box, and in effecting the changes the lever at the right-hand end of the box is moved upwards, after releasing its locking pin, the slide beneath the plate is then moved along till it corresponds with the feed column required, when the lever is moved downward till the mechanism is brought into gear again. The feed series is quadrupled in number by means



Universal Milling Machine.

* For Articles I. to XX., see previous issues.

of back gears operated by the two small levers on the gear case.

The feed drive is taken direct from the pulley shaft of the machine by means of a chain and sprocket wheels; as the pulley shaft runs at a constant speed the rates of feed are independent of the spindle revolutions, this, of course, being an obvious necessity to compensate for differences in material acted upon, diameters of cutters, and depth of cut.

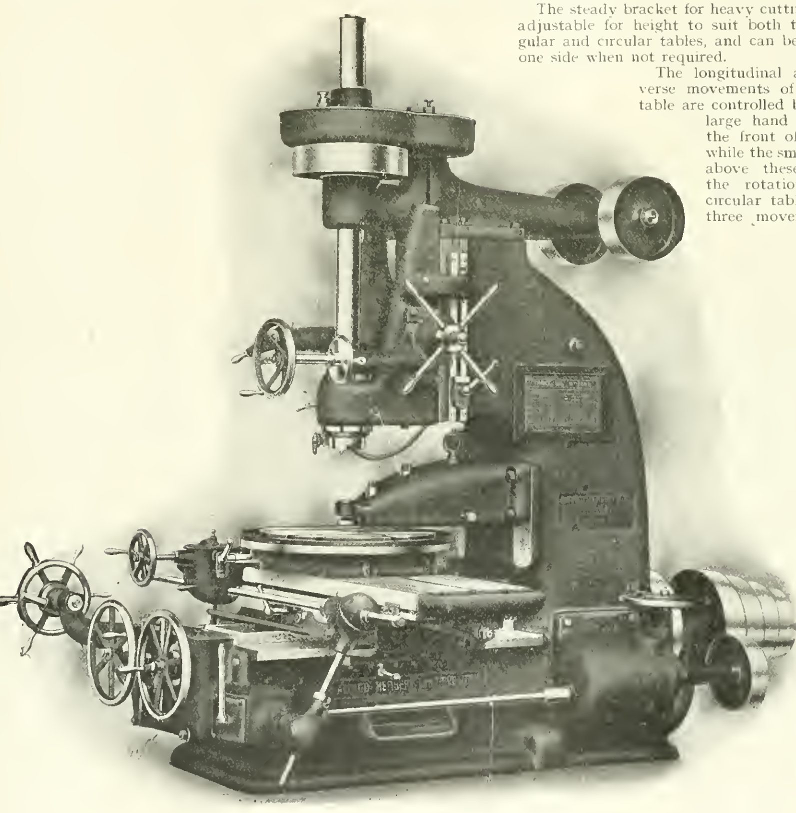
The motion is transmitted from the change box to the gearing contained in the knee by the extension spindle and sleeve, which operates the gearing in the reversing box on the side of the knee. The small lever seen on the front of this box serves to start, stop and reverse all the feeds, separate control levers being also fitted; the two short levers on the right of the knee control the transverse and vertical feeds, through the required arc, and fixed by means of a stop fitting into the holes bored in the dividing plate.

The vertical type of machine here illustrated is manufactured by the eminent Coventry firm of Messrs. Alfred Herbert, Ltd. The spindle is rotated by belt drive taken from the stepped pulley shaft over the pair of pulleys supported off the head, the spindle is keyed to a sleeve, in which it slides vertically, the belt pulley being fixed to this sleeve; there is thus no side pull on the spindle.

The arbor is raised and lowered by the movement of the sliding head, the pilot wheel on the side of which provides for quick setting, fine adjustments and downward feed being made by means of the hand wheel with micrometer disc on the front of the head; the locking lever is seen to the left of this wheel.

The steady bracket for heavy cutting is made adjustable for height to suit both the rectangular and circular tables, and can be swung to one side when not required.

The longitudinal and transverse movements of the plain table are controlled by the two large hand wheels on the front of the bed, while the smaller wheel above these operates the rotation of the circular table. These three movements are



Patent Vertical Milling and Profiling Machine.

the longitudinal traverse being operated by another lever on the front of the knee; the ranges of these feeds are in this model 8, 18 and 25 inches respectively, with automatic trip gear.

The movements of the table are also controlled by the hand wheels for rapid setting, micrometer discs being provided for accurate adjustments. The table can be swivelled upon the graduated base to give an angular movement for special cuts.

A dividing head for gear cutting or spiral forming is shown, this is automatically operated by feed gear and change wheels, and for dividing up circular work, such as pitching the teeth in gear cutting, the part is rotated upon the centre

also obtained by automatic feeds through the gear box seen on the side of the machine. This gearing has a separately belt-driven pulley, and the feeds are controlled by horizontal hand wheel, having a graduated dial upon it, the changes being effected by simply moving the wheel to bring the feed as marked upon the dial, opposite a pointer. Automatic trip gear is fitted to the feed motions, and the starting, stopping and reversing is governed by the lever seen on the reverse box at the front.

The capstan wheel seen on the extreme left is provided for a special profiling attachment for the production of irregularly formed parts.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Falk.—On May 27th, Messrs. William Dobson & Co. launched from their shipbuilding yard at Walker a steel screw steamer which they have built to the order of Mr. Alf. Monsen, of Tonsberg. This steamer is built to the highest class at Norske Veritas, and is of the single-deck type with the following dimensions:—Length between perpendiculars, 280 ft.; breadth, 40 ft.; depth moulded, 20 ft. 8 in. The engines and boilers are being constructed by the North-Eastern Marine Engineering Co., Ltd., of Wallsend, the cylinders being 20½ in., 33 in., 54 in. diameter by 36 in. stroke. The vessel is supplied with a Cochran (Annan) donkey boiler with patent seamless furnace. Before leaving the ways the vessel was named *Falk* by Miss Bell, of Hull.

Eimstad.—On May 28th, Messrs. Robert Thompson & Sons, Ltd., launched from their Southwick Yard the steel screw steamer *Eimstad*, built to the order of Messrs. Grefstad and Herlofsen, Arendal, Norway. She is built to take the highest class in Det Norske Veritas. Her principal dimensions are—Length B.P., 195 ft.; breadth, 35 ft.; depth moulded, 13 ft. 3 in. The erections consist of raised quarter deck covering the engine and boiler space, bridge amidships for the accommodation of captain and officers, a steel house for engineers at the after end of the engine casing, topgallant forecastle for accommodation of crew, and a steel chart house on the bridge deck with flying bridge above. Ample water ballast is provided in the double bottom and fore and after peaks, the former being divided both longitudinally and athwartships for trimming purposes. The machinery being fitted aft, one large and spacious hold is left clear of all obstructions for stowage of cargo. There are three large hatchways worked by powerful steam winches by Messrs. J. Wigham & Son, with steam from vertical multitubular donkey boiler by Messrs. Cochran & Co., Annan, Ltd., placed in the stokehold. The steam windlass has been supplied by Messrs. Emerson, Walker & Thompson, Bros., Ltd., and steam and hand combined steering gear by Messrs. Alley & MacLellan, Ltd., Glasgow. The engines are of the triple-expansion type by Mr. George T. Grey, of South Shields, having cylinders 14 in., 23 in. and 38 in., with a stroke of 27 in., steam being supplied by a large boiler working at 180 lbs. pressure. After the successful launch, the christening ceremony being gracefully performed by Mrs. S. Renny Pinkney, of Sunderland, the party returned to the offices of the builders, where light refreshments were partaken of and the usual toasts proposed and responded to.

Dorset Coast.—On May 30th, Messrs. W. Harkess & Son, Ltd., launched from their yard at Middlesbrough a finely modelled screw steamer built to the order of Messrs. F. H. Powell & Co., of Liverpool, for their special coasting trade. The principal dimensions are:—Length, 180 ft.; breadth, 29 ft. 6 in.; depth moulded, 15 ft. She is fitted with exceptionally heavy deck machinery and cargo gear, and her engines by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, are intended to give a speed of 10 knots loaded. On leaving the ways she was gracefully christened *Dorset Coast* by Mrs. Pritchard, wife of the manager of Messrs. Powell's chartering department. The vessel has been built in excess of and to Lloyd's highest class, under the superintendence of W. Law, junr., Esq., of Liverpool and is the sixth vessel built for Messrs. Powell by Messrs. Harkess within five years.

Premier.—On May 30th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 127 ft. by 22 ft. by 12 ft. 9 in. moulded. The vessel has been built to the order of Messrs. The Anchor Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. Charles D. Holmes & Co. of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Premier* by Miss Ella Letten, of Gravesend, after which the company adjourned to the builders' offices, where the customary toasts were given and responded to.

Bida.—On June 13th Messrs. W. Harkess & Son, Ltd. launched from their yard at Middlesbrough a handsome twin screw mail and passenger steamer which has been built to the order of Messrs. Elder, Dempster & Co. for their branch service on the West Coast of Africa. The vessel's dimensions are:—225 ft. by 36 ft. by 14 ft. She will carry 1000 tons of cargo on light draught, is built to Lloyd's class and a full specification, and carries Board of Trade certificate for about 900 passengers in all. The twin-screw engines are being built by Messrs. MacColl & Pollock, Ltd., of Sunderland, and are expected to drive the vessel at a speed of 11½ knots per hour. On leaving the ways she was named *Bida* by Mrs. A. Weatherhead, wife of the secretary to the builders.

Cressington Court.—On June 13th, Messrs. Richardson, Duck & Co. launched from their yard at Stockton-on-Tees a fine steamer of the following dimensions:—Length overall, 368 ft.; breadth extreme, 50 ft.; depth moulded, 30 ft. 2 in.; deadweight about 7400 tons. This vessel, which has been built to the order of The Cressington Steamship Co., Ltd. (Messrs. Haldinstein & Co., Ltd., managers), of London, will class 100 A1 in Lloyd's register, and has been built under special survey. She is a single-deck steamer built to the three-deck rule, with poop for cargo, bridge and topgallant forecastle. Accommodation for captain, officers and engineers is provided in steel deck-houses on bridge deck, crew being berthed in topgallant forecastle. A cellular double bottom throughout and peak tanks are fitted for water ballast, and equipment includes eight steam winches, large horizontal multitubular donkey boiler, steam windlass with quick-warping ends, double derricks with derrick tables and crosstrees on masts, stockless anchors, steam-steering gear, etc., etc. The engines by Messrs. Blair & Co., Ltd., have cylinders 26 in., 42½ in. and 69½ in. with a stroke of 45 in., steam being supplied by two single-ended boilers, having a working pressure of 180 lbs. The vessel has been supervised by Mr. W. B. Cumming, the owners' superintendent, during her construction. As the vessel left the ways she was christened *Cressington Court* by the Hon. Mrs. Gilbert Rollo, wife of the chairman of the Cressington Steamship Co., Ltd.

Tempus and **Edale.**—On June 13th, Messrs. Joseph Scarr and Son launched from their Howden yard two steel screw barges, 70 ft. by 19 ft. 6 in. by 8 ft., carrying capacity 200 tons, built to the order of Messrs. Joseph Rank, Ltd., of London, under the supervision of Mr. W. Townhill, marine surveyor, Hull. The vessels were christened *Tempus* and *Edale* as they left the ways.

Fameliaris.—On June 15th, Messrs. William Gray & Co., Ltd., launched at West Hartlepool the handsome steel screw steamer *Fameliaris* for Mr. Basilies N. B. Fameliaris, Syra. She will take the highest class in Lloyd's register and is of the following dimensions, *viz.*:—Length overall, 342 ft.; breadth, 47 ft. 6 in.; and depth, 25 ft., with long bridge, poop and topgallant forecastle. The saloon, state-rooms, captain's, officers' and engineers' rooms, etc., will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom and large aft peak ballast tank, six steam winches, steam steering gear amidships, hand-screw gear aft, patent direct steam windlass, large patent donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in. and 64 in. diameter, with a piston stroke of 42 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. The ceremony of naming the steamer *Fameliaris* was performed by Mr. Constantin G. Calapodopoulos, of Syra.

Grovehill.—On June 15th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, launched the handsome steel screw steamer *Grovehill*, built for the Rederiaktiebolaget "Groveland," of Landskrona. She is of the following dimensions:—289 ft. 6 in. by 40 ft. 2 in. by 20 ft. 6½ in., having single deck, poop, bridge, and topgallant forecastle, and has been built to the British Corporation Registry's highest class. A double bottom is fitted throughout on the cellular principle and the after peak is arranged as a trimming tank. She is constructed with bulb angle frames and longitudinal stringers giving clear holds for the storage of bulky cargoes, and the bulwarks have been specially

strengthened for the carriage of deck cargoes. Four water-tight bulkheads divide the holds into five water-tight compartments. She also has extra large cargo hatches, four steam winches which are supplied with steam from a vertical, multitubular donkey boiler, by Cochran & Co., Annan, Ltd., and is replete with all the latest improvements for rapid loading and discharging. A powerful quick-warping steam windlass is fitted forward for the working of the cables and steam-steering gear is fitted amidships with hand screw gear aft. Accommodation for captain and officers is arranged in poop, engineers in houses amidships, crew and firemen in forecastle. The cabins throughout have been heated with steam and the sanitary, ventilating and lighting arrangements have received special attention and have been effected on the most approved lines. Triple-expansion engines are being supplied and fitted by Messrs. MacColl & Pollock, Sunderland, having cylinders 20½ in., 33 in., 54 in. and 36 in., two large S.E. boilers 180 lbs. pressure. As the vessel left the ways she was gracefully christened *Grovehill* by Mrs. Chas. H. Ford, of West Hartlepool.

Brika.—On June 16th, Messrs. R. Craggs & Sons, Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer, 362 ft. long, 49 ft. 9 in. beam, 25 ft. 10 in. depth moulded. This vessel is being built under special survey in excess of the highest class under Lloyd's three-deck rule, with one deck laid, having poop, bridge and forecastle. Accommodation is provided for captain, officers and engineers in spacious deck-houses on bridge and the crew in the forecastle. The framing of the steamer is constructed on the builders' special design, known as the "C" system, whereby greatly increased strength is secured at the tank side and above, with increased carrying capacity, and another feature is the arrangement of clear holds, the deck being supported upon girders and wide-spaced mast pillars placed well clear of hatch sides. Cellular double bottom is fitted throughout for water ballast, also fore and after peaks, the total amount provided being about 1250 tons. Eight powerful steam winches are provided of the most approved type. Steam-steering gear is supplied and improved quick-warping steam windlass is fitted forward. The machinery will be fitted by The North-Eastern Marine Engineering Co., Ltd., of Sunderland, and will have cylinders 23½ in., 39 in., 66 in. by 45 in. stroke, steam being supplied by three large single-ended boilers working at 180 lbs. pressure to the square inch. The vessel has been built to the order of the English and American Shipping Co., Ltd. (Messrs. C. T. Bowring & Co., Ltd., managers), of London, and on leaving the ways was named *Brika* by Mrs. Cyril Webster, daughter of Alex. T. Hay, Esq., a director of the company. The specifications have been supervised and the construction of the hull and machinery has been superintended by Messrs. Jacobs and Barringer, of London, and Captain Towill.

Kildin.—On June 16th, Messrs. William Dobson & Son launched from their shipbuilding yard at Walker the steel screw steamer *Kildin*, which they have built to the order of the Archangel Mourman Steam Navigation Co., of Archangel. This vessel is built to the highest class at Lloyd's, and is of the single-deck type of the following dimensions:—Length between perpendiculars, 260 ft.; breadth, 38 ft.; depth moulded, 20 ft. 6 in. The triple expansion engines which are being constructed by the North Eastern Marine Engineering Co., Ltd., have cylinders 19 in., 31 in. and 51 in. diameter by 36 in. stroke, steam being supplied by two single-ended boilers. The vessel is supplied with a Cochran (Annan) donkey boiler with patent seamless furnace.

Varonil.—On June 16th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 127 ft. by 22 ft. by 12 ft. 9 in. moulded. The vessel has been built to the order of Messrs. The Atlas Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes and Co., of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Varonil* by Mrs. S. C. Smethurst, of Grimsby, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Athinai.—On June 17th, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough-on-Tees, a handsomely modelled twin-screw mail and passenger steamer built to the order of Greek owners. Her principal dimensions are 436 ft. by 52 ft. by 30 ft. 2 in., moulded, with a deadweight carrying capacity of about 7000 tons. The vessel is being built to class 100 A1 at Lloyd's, three-deck rule with shelter deck and forecastle and large midship house for passenger accommodation, and will also be constructed to fulfil the requirements of the British Board of Trade and American and Italian certificates for emigrants. The spacious steel house amidships will contain luxurious accommodation for about 100 first-class passengers on shelter and promenade decks, with saloon, smoke-room, ladies' room and entrance halls, etc., and about 2000 emigrants will be accommodated in lower and upper 'tween decks, with officers in house on forward part of boat deck and engineers on shelter deck aft, while the crew will be berthed in forecastle 'tween decks. The vessel will be equipped with a complete installation of electric light and bells, and fitted with large refrigerating chambers. She will have two funnels, two masts, eight derricks, eight winches and windlass, fourteen boats, seven water-tight bulkheads and all the latest and most modern appliances for the comfort of passengers and rapid handling of cargo. Twin-screw triple-expansion engines having cylinders 22½ in., 37 in. and 61 in. by 42 in. stroke supplied with steam by four large single-ended boilers working at 180 lbs. pressure will be fitted by the North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne. On leaving the ways she was named *Athinai*. The hull and engines are being constructed under the supervision of Mr. A. Z. Kairis, of Cardiff, the owers' superintendent.

LAUNCHES—Scotch.

Modwena.—On June 1st, Messrs. John Reid & Co., Ltd., shipbuilders, Whiteinch, launched a 400-ton barque-rigged auxiliary yacht, which they are completing for Mr. Edgar Thornton, of Ryde, Isle of Wight. On leaving the ways she was named *Modwena* by Mrs. Thornton, wife of the owner. This is a vessel of more than usual interest, as she has been specially designed by her builders for distant cruising, and is the first ocean-going yacht that has been fitted with a motor, which, it is expected, will be of great use in propelling her through calms, and also in leaving and entering harbours.

Mourilyan.—On June 16th, there was launched from the yard of Messrs. Alex. Stephen & Sons, Ltd., Linthouse, the twin-screw steamer *Mourilyan* which they have built to the order of the Howard Smith Company, Ltd., Melbourne. Her dimensions are:—Length, 220 ft.; breadth, 36 ft.; depth, 20 ft., and she has been designed by Messrs. Stephen to meet the growing demand of the Australian coast for fast vessels carrying first-class passengers between local ports. The *Mourilyan*, which will run in connection with the s.s. *Cooma*, built early last year by the same builders for the same owners, will take up the Howard Smith Company's sailings between Cairns and Townsville on the Northern Queensland coast, and on account of the small depth of water at some of the ports she will carry a moderate amount of cargo on a shallow draught, the trade being principally in passengers between the two ports. Her main deck is completely fitted up with state-rooms for first and second-class passengers, the accommodation for either class being almost identical. On the awning deck are situated large dining saloons with the necessary pantries and galleys adjoining. The first-class music and smoking-rooms are placed on the bridge deck, which is completely covered with a boat and promenade deck—the main feature of the vessel being a maximum ventilation with a minimum exposure to the sun, in order to suit the tropical climate of Northern Queensland, and in this connection it should be mentioned that a complete system of mechanical ventilation has been fitted throughout with, in addition, electric fans in each state-room and all the public rooms—these last being under the control of the individual passenger. There is also an installation of refrigerating machinery, with cool chambers for provisions of all kinds, and an ice-making machine has also been fitted for the use of the passengers. She has been built to Lloyd's heaviest awning deck class, and has been under the superintendence of Mr. W. E. Forster, the London representative of the Howard Smith Company. Immediately after the launch she

proceeded up the river to the harbour, where two sets of triple-expansion engines and two large boilers will be shipped. The machinery has also been constructed by Messrs. Stephen, and is designed to maintain a high rate of speed. The christening ceremony was performed by Miss Margaret F. Stephen, daughter of Mr. A. E. Stephen.

Madie.—On June 16th, there was launched at Bowling by Messrs. Scott & Sons, a coasting steamer of 300 tons, named *Madie*, built to the order of Messrs. James Henry Monks (Preston), Limited, of Preston. Messrs. Ross & Duncan, Govan, will supply the machinery.

Slains Castle.—On June 16th, a wooden drifter named *Slains Castle* was launched by Messrs. Carnegie & Mathew, Peterhead, for Messrs. J. Mitchell and others, Peterhead. Her dimensions are :—Length, 84 ft. 6 in. ; breadth, 18 ft. 6 in. ; depth, 9 ft. 6 in.

Sutlej.—On June 16th, there was launched at Whiteinch by Messrs. Charles Connell & Co., Ltd., the screw steamer *Sutlej*, for Messrs. James Nourse Ltd., London. The vessel, which is a sister ship to the *Ganges*, the *Indus* and the *Mutlah*, recently built by the same firm, is specially designed for the carrying of natives between the East and West Indies. The naming ceremony was performed by Mrs. A. C. Hay, Liverpool. Machinery for the vessel will be supplied by Messrs. David Rowan & Co., and she will have large boilers fitted with Howden's forced draught.

Star of Bethlehem and **The Brae.**—On June 18th, there were launched at Aberdeen by Messrs. Hall, Russell & Co., Ltd., two steel drifters built to the order of Messrs. John Foreman & Brothers, Buchanhaven, and Mr. John Reid and others, Peterhead. The vessels were named the *Star of Bethlehem* and *The Brae* respectively. The dimensions are :—Length, 82 ft. ; breadth, 18 ft. 3 in. ; and depth, 9 ft. 3 in. The engines and boilers will be fitted by the builders.

TRIAL TRIPS.

Tagona.—On May 26th, the new steamer *Tagona*, just completed by Messrs. Archd. McMillan & Son, Ltd., Dumbarton, for Canadian owners, went down the Firth on her trial trip. The vessel is of the package freight type, and arranged for the handling of large quantities of cargo on the St. Lawrence river and Canadian lakes, and has hoisting gear for this purpose. The *Tagona* is a sister ship to the *Regina* and *Kenora*, built for the same owners, and is the sixth vessel recently completed by the builders for the Canadian lake service. The trial trip was in every way satisfactory, and the vessel returned to Glasgow to load.

Belle Ile.—On June 1st, Messrs. Osbourne, Graham and Co. sent to sea for her official trial the steel screw steamer *Belle Ile* (of which we gave particulars in our May issue, page 419), which they have specially constructed to the order of Messrs. Fearnley & Eger, of Christiania. During the trial everything was satisfactory, a speed of over 10 knots being easily attained. After the trial the vessel proceeded to Blyth to load her first cargo, under the command of Captain Sand, who has superintended the construction of the vessel.

Rotterdam.—The construction of this fine large twin-screw steamer by Messrs. Harland & Wolff, Belfast, for the Holland-America Line's service between Rotterdam and New York reached its consummation on Wednesday, the 3rd June, when the huge liner—which is by far the biggest ship of the year—left the quay and proceeded down Belfast Lough for adjustment of compasses and trial trip, prior to leaving for Rotterdam *via* Southampton. Owing to her large size the *Rotterdam*, like the two large vessels built by Harland & Wolff last year, the *President Lincoln* and *President Grant*, could not be dry docked in Belfast. This important work, however, in connection with a Belfast-built steamer presents little difficulty now through the association of Belfast with Southampton, since Messrs. Harland & Wolff opened works at the southern port, where, as is well known, the docking facilities are exceptionally good. On the way round to Rotterdam, therefore, the vessel called at Southampton, where Messrs. Harland & Wolff dry docked and completed her with little delay, thanks to the convenient situation of that port geographically and also the convenient position of their works in the Southampton docks. It will thus be seen that, as was anticipated at the time, Messrs. Harland & Wolff's establishment of a branch at Southampton was not only a most important development for them, but also a distinct advantage to Belfast, which is thus associated with one of the most progressive ports in the kingdom through their instrumentality. The *Rotterdam*, besides being one of the largest, is by common consent one of the handsomest vessels ever built. Like the other vessels of the line, she has been constructed to the highest class of Lloyd's under special survey and to meet all the requirements of the British Board of Trade and the American Law for passenger vessels, and the new vessel in every respect, in design, construction and decoration, represents the highest excellence yet attained in naval architecture. The enterprise, judgment and foresight of the owners, in conjunction with the ripe experience and practical knowledge of the builders, have left nothing undone to ensure the vessel being not only a work of art, but an embodiment of every element that mechanical skill and ingenuity can devise to enhance the pleasure and secure the safety of ocean travellers. The *Rotterdam* is nearly 25,000 tons gross register, with a displacement of over 35,000. She is an exceptionally strong structure, having nine steel decks and being built on the cellular double bottom principle, the double bottom extending the whole length of the ship, the depth of the inner vertical keel being 4 ft. 9 in. throughout, excepting under the engines, where it is increased to 5 ft. 7 in., the object of this, of course, being to give still greater rigidity in the vicinity of the machinery. The vessel has twelve water-tight bulkheads, being thus divided into thirteen water-tight compartments. There is also a centre-line bulkhead in the cargo holds and 'tween decks. The double bottom, of course, in addition to being an element of strength and security, provides space for water ballast, which is also carried in the fore and aft peaks and in deep tanks forward. The arrangements for cargo are of the most approved kind ; there are seven cargo holds with hatches suitable for working grain elevators, and the bunkers are arranged so that the vessel can be completely coaled from either side. The vessel has two masts and two funnels. The cargo derricks are of the latest tubular type. The steam winches, windlass, capstan, boat davits and other appliances for working ship and cargo are also of the latest pattern. The *Rotterdam* is fitted with a large refrigerating installation for both cargo and provisions, which also allows a complete system of cold storage in all the pantries for wine, cold dishes, etc., and iced water is led to different positions throughout the entire vessel. The electric power and light machinery is also of large capacity, there being an electrical elevator, electric service lift, also an electric hoist for stores, in addition to the electric fires and heaters, bells, fans, cooking apparatus, etc., and the enormous number of lights, something approaching nearly 5000 throughout the ship. There are two patent fire-extinguishing machines, one forward and one aft, with a complete system of piping leading to every part of the vessel, thus ensuring practical immunity from fire. The steering engines and gear is of Harland & Wolff's latest type, controlled from the captain's bridge by means of a telemotor. This well-known gear, with which, by means of an ingenious arrangement of steel springs, the shocks and strains on the rudder are minimized, has long been regarded as an important element of safety in a ship. The propelling machinery consists of two sets of quadruple-expansion engines, with eight double-ended and two single-ended boilers. The engines are arranged on the "balanced" principle, by the scientific development of which the builders have attained a high degree of perfection with reciprocating engines, both as to the efficiency of their motive power and the abolition of vibration in the ship. The general disposition of the passenger accommodation leaves nothing to be desired, the arrangements for all classes being conceived with a view to ensuring the utmost comfort and enjoyment. Whether in the magnificent public rooms in the first-class, including the handsome saloon, smoke-room, library, palm court, etc., the cabines de luxe, or in the second-class rooms or the third-class accommodation, all have been designed on the same generous scale, with the one object of meeting the requirements of respective classes of passengers. The dining saloons are the full width of the ship, the first-class saloon providing seating accommodation for nearly 500 passengers, and the second-class saloon for 300. The height of the upper and lower smoke-

rooms is 10 ft. 6 in. each, so that the total height of the combined room is 21 ft. The social hall is 11 ft. 6 in. high, and the palm court—which is an entirely new feature in naval architecture—is also of exceptional height. The total number of passengers and crew will be close on 4000. The arrangements in this ship for the benefit of the large number of passengers to be carried are most complete. The heating and ventilation will be as perfect as mechanical ingenuity can ensure; the galleys and pantries have been specially studied with a view to the rapid and efficient serving of meals, and the electric elevator serves six decks, conveying passengers from the first-class entrance on the middle deck up to the palm court, stopping *en route* when required at the saloon entrance, two intermediate decks and the social hall. As is usual in vessels of the Holland-America Line, the *Rotterdam* has a children's saloon or nursery, and there is a fruit and flower room, with special lockers for preserving passengers' own fruit and flowers. Special attention has been paid to the decoration of the public rooms, entrances and state-rooms in this steamer. A special feature of the first-class accommodation is the large number of one and two-berth rooms, also suite rooms with private baths, these suite rooms being fitted with brass bedsteads. All upper berths in first-class state-rooms are Pullman berths which give a much more roomy and tidy appearance than the ordinary arrangement. The promenade spaces on this vessel are exceptional, and on the upper promenade deck a new feature has been introduced by the company, *viz.*, an arrangement of large frameless plate-glass windows across the front and along the sides nearly the whole length of this deck, doing away with the old canvas screens which had many disadvantages. At the same time the passengers have the great advantage of a covered-in promenading space without any interruption in their view of the horizon. The windows can be lowered and kept in any position by an ingenious arrangement of springs, making the deck an ideal promenade, which will doubtless be greatly appreciated by the passengers. The decoration of the second-class public rooms in this ship is of a very high order, and the comfort of the third-class passengers is all that could be desired, the accommodation for them being excellent, the enclosed cabins being large and comfortable, and separate dining, smoking and general rooms being provided, also open and enclosed promenading spaces. The vessel is fitted with the very latest and most improved Marconi system and has also for the safety of the ship and passengers a submarine signalling apparatus. Mr. Wierdsma, the president-director of the company, arrived from Rotterdam with a large party of friends, and his son, Mr. Rypperda Wierdsma, who is also a director, joined the ship, having arrived at Queenstown by the *Lusitania* from New York. Mr. Van Helden, the engineer-in-chief of the company, under whose direction and superintendence the ship was constructed and completed, also joined the vessel for her trial trip, and the ship left under the command of Captain F. H. Bonjer, the commodore captain of the Holland-America Line, whose entire mail fleet, except the *Potsdam* was built and completed in Ireland, the *Rotterdam* being the fourteenth vessel for this company first floated in the waters of the Lagan.

San Giorgio.—On June 12th, a new seagoing fire and salvage boat, built by Messrs. Merryweather & Sons, of London, for the Genoa Harbour Board, underwent its official trials on the Thames. A trip was made from Greenwich to Tilbury, where the pumping capabilities of the vessel were demonstrated. As evidence of what the pumps are capable it may be mentioned that a powerful 3 in. diameter jet was cast to a height of over 200 ft. Two jets each 2¼ in. diameter were then brought into play, and afterwards, with the aid of flexible hose and branch pipes, as many as twelve jets were discharged simultaneously. The propelling and pumping tests were in every way satisfactory, and the vessel travelled over the measured mile at Long Reach at 10 knots an hour (one knot in excess of the contract speed). The vessel is called the *San Giorgio*, and is 70 ft. long with 16 ft. beam, and draws 5 ft. of water. It is propelled by two double-cylinder compound engines driving twin screws, and the fire engines are of the double-cylinder "Greenwich" pattern, with a total pumping capacity of over a quarter of a million gallons per hour. For fire extinguishing the pumps take water through the side of the vessel, but for salvage purposes the suction is taken through two deck connections with 6 in. pipes. Two Merryweather quick steam-raising boilers supply the steam, and by means of an oil-fired heater a low pressure of steam can always be maintained in one of the boilers, thus affecting a considerable saving of time in raising steam for starting the vessel.

Deux Frères.—On June 19th, the new steel screw steamer *Deux Frères* (of which we gave particulars in our April issue, page 381), built by Messrs. Wood, Skinner & Co., Ltd., Bill-Quay-on-Tyne, to the order of Messrs. Bretel Frères of Valognes, left the Tyne for her official trial trip. The propelling machinery, which has been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of triple-expansion engines having cylinders 14 in., 23 in., and 39 in., with a stroke of 27 in., steam being supplied by a large steam boiler working at a pressure of 180 lbs. per square inch. During the trial run the machinery worked without the slightest hitch, and gave every satisfaction to all concerned, a good speed being maintained throughout. Amongst those present on the trial were Mr. Collet, under whose supervision both hull and machinery have been constructed, Mr. Skinner, senior, representing the shipbuilders, and Mr. J. Daglish representing the engine builders.

Whitby Abbey.—On June 19th, the finely modelled steel screw steamer *Whitby Abbey*, built by Messrs. W. Gray and Co., Ltd., West Hartlepool, to the order of Messrs. The Hull and Netherlands Steamship Co., Ltd., Hull, for their fast daily service between Hull and Rotterdam, was taken to sea for her official loaded trial. The vessel takes the highest class in Lloyd's Register, and her dimensions are :—Length, over all, 265 ft ; breadth, 33 ft. 8 in. ; and depth, 16 ft. 3 in. She has a full poop-raised quarter deck, long bridge and top-gallant forecastle ; a handsome saloon, smoke-room and cabins for forty-four first-class passengers amidships, accommodation for twenty-eight second-class passengers in the poop, and forty-four steerage passengers forward. The ship is lighted throughout by electricity and fitted with electric bells and steam heaters. Stalls are provided for carrying forty horses. The hull is built with deep bulb-angle frames, a cellular double bottom and peak tanks, large hatchways, five steam winches, steam-steering gear, steam capstan aft, steam windlass, and a complete outfit for a first-class passenger and cargo steamer. The machinery was made at the Central Marine Engine Works of the builders. The engines have cylinders 25½ in., 40½ in. and 67 in. diameter, with a piston stroke of 42 in., embodying special features to give the required power to drive the vessel over 15 knots per hour. Three boilers of the Central Marine Engine Works' well known type, with flanged shell, adapted to work at a steam pressure of 185 lbs. per square inch, and fitted with Howden's system of forced draught and internal feed heaters, have been supplied. The engine-room is replete with numerous auxiliaries for adding to the efficiency of the machinery, including Quiggin's patent feed heater and feed filter, Amos & Smith's centrifugal circulating pump, Mumford's feed and ballast pumps, Aspinall's patent governor, Cederwell's patent lubricating box fitted to the stern tube, and See's patent ash ejector. An exhaustive trial extending over 200 miles was made at full speed starting from Hartlepool, out to sea and finishing off the Spurn lightship. The 200 miles as registered by the log was covered in 12 hours 56 minutes, an average speed of 15·47 knots per hour, the maximum reading was 15·8 knots. We may add that the contract speed of the ship was 15 knots. The performance of the vessel and the working of her machinery were throughout the trial satisfactory in all respects. The owners were represented by Mr. W. H. Brodrick, M.I. Mech.E., and Capt. Pearse ; the builders by Capt. Murrell, and the engine works by Mr. M. S. Gibb and Mr. J. B. Williams. The steamer will take up her station on the line at the end of this week, and we have every expectation that with her sister ships the Hull and Netherlands Company will find these vessels admirably fitted for this service.

Comet.—The motor launch *Comet*, designed and built for Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., the well-known Tyne shipbuilders, by Mr. James A. Smith, M.I.N.A., has completed her trials in a very satisfactory manner. The dimensions of the launch are 53 ft. by 10 ft., and the motor installation by Messrs. Norris & Henty, consists of a 4-cylinder Gardner paraffin motor of 75 h.p., with Gardner clutch, reverse gear and thrust. The hull is of galvanized steel

with teak rails and interior fittings. A large day cabin is fitted forward, constructed of teak, with railway carriage windows all round, and there are two large open cockpits or wells. The motor room is fitted amidships, consisting of a roomy steel house with a large steel skylight, and doors at either end. During the official trials, which were of an unusually severe nature, the launch ran nearly 120 miles at full power, practically the first time the motor was run.

Berrie Braes.—On June 10th, the steam herring drifter *Berrie Braes*, built by Messrs. George Innes & Son, Portknockie, and engined by Messrs. Menzies & Co., Ltd., Leith, to the order of Messrs. G. G. Wood & Co., Portknockie, ran satisfactory trials on the Firth of Forth, when a speed of ten and a half knots was attained.

Wacousta.—On June 10th, the new steamer *Wacousta* (of which we gave particulars in our June issue, page 462), built by Messrs. Archibald M'Millan & Son, Ltd., Dumbarton, and engined by Messrs. J. C. Kincaid & Co., Ltd., Greenock, for Mr. P. A. Gron, Sandefjord, Norway, ran trials on the Firth of Clyde. On two runs between the Cloch and Cumbrae Lights a speed of about $12\frac{3}{4}$ knots was attained, the machinery working with great smoothness throughout. The machinery, which is placed aft, consists of a set of triple-expansion engines, having cylinders 25 in., 42 in. and 68 in. The vessel and machinery have been constructed to the highest class of Norwegian Veritas. Among those present at the trial trip were Mr. and Mrs. K. Gron, Sandefjord; Mr. A. D. Christensen, Mr. James Moir, Mr. and Mrs. W. M. M'Millan, Mr. S. J. M'Millan, Mr. J. C. Kincaid and others.

Teyr-el-Bahr.—Lately the Egyptian Government tug *Teyr-el-Bahr*, built by Messrs. P. M'Gregor & Sons, Kirkintilloch, to the order of Mr. A. M. Gordon, Glasgow, ran successful trials on the Gareloch. This vessel has been built to replace the *Darfeel*, launched by Messrs. M'Gregor last year, and totally lost in November within one day's steaming of her destination.

Messrs. WAILES, DOVE & Co.'s Bitumastic Enamels have been applied to bunkers, tanks and tank top of the s.s. *Tamarac*.

CONSULTING ENGINEER. Mr. James Anderson informs us that he has commenced business at 128, Hope Street, Glasgow, as a Consulting Engineer.

Messrs. S. T. TAYLOR & SONS, have covered boilers, pipes, etc., of the s.s.'s *Stylian*, *Bebis* and *Burwah* with their "Tynos" non-conducting material, and covered boiler of s.s. *Ethel* with their "Tynos" non-conducting material; also covered boiler bottom of s.s. *Virginian* with their "Tynos" Patent Removable Asbestos Mattresses.

THE PARSONS MOTOR CO., Town Quay, Southampton, have the following orders in progress: two 28 h.p. Parsons Marine Motors and Propeller Sets, for a fast motor cruiser to the design of Mr. Fredk. Shepherd. The motors will be placed forward and will run in opposite directions, *i.e.*, with the motors in the same relative position to pair up, and not by turning one motor end for end. The engine-room will therefore be perfectly symmetrical. Paraffin is the fuel. A 28-h.p. set has been ordered for the motor cruiser *Lurline*, the property of a prominent Southampton owner, and has to be installed with reverse gear and propeller set to replace a French motor which is not satisfactory. An order for a 21-h.p. engine (paraffin fuel), with reverse gear and propeller set, has been received from one of the largest firms in Italy, and is the first of a number of engines they will be wanting for their Motor Boat Department, which they are developing. A 14-h.p. engine has been ordered by Messrs. Clayton Co., for coupling to one of their special fire-extinguishing and ventilating outfits, and this is to be coupled up to a large blower. Blow lamp starting will be used, and paraffin fuel only. From South America an order is to hand for a 14-h.p. engine with reverse gear and propeller set for fitting to a launch in Paraguay, this following on a Parsons outfit shipped to that part a little while back. Their tender which was submitted for 20-ft. motor launch for the Customs Department for Southampton has been accepted, and the boat will be fitted with a 14-h.p. Parsons outfit complete with all details to the department's special requirements. The last order received was for a 7-h.p. auxiliary to a 10-ton yacht, locally owned, and this is now being installed.

OBITUARY.

WILLIAM TODD LITHGOW.—We put on record with regret the death of Mr. William Todd Lithgow, senior partner of the well-known Clyde shipbuilding firm of Russell & Co., Port Glasgow, the sad event taking place on June 7th, at his home, "The Drums," Langbank. Laid aside by severe illness last year, the hopes, after partial recovery, that a period of rest from business would eventually result in complete restoration to health were not destined to be realized, and Mr. Lithgow, still in the very prime of life and the thick of business achievement, passed away in his 54th year. Deceased was a native of Port Glasgow, and from his early youth was intimately connected with the shipbuilding industry. He served his apprenticeship as a draughtsman with the firm of Messrs. John Reid & Co., Port Glasgow, now of Whiteinch, afterwards joining the drawing staff office of Messrs. Russell & Co., when that firm in addition to carrying on the shipyard in the east-end of Port Glasgow established the present extensive yard at Kingston, to the west of the town. While serving the firm as chief draughtsman he was invited to join in partnership with Mr. Joseph Russell and Mr. Anderson Rodger in carrying on and greatly extending the new establishment, while at the same time operations were continued in the east yard. For a number of years also the firm carried on operations in the yard at Greenock, now occupied by the Greenock and Grangemouth Dockyard Co. The staple productions of the east yard and that at Kingston for many years were sailing ships, a large proportion of the output being for French and other Continental owners. Sailing ships of the largest tonnage of their day were repeatedly sent off the stocks at Port Glasgow, the yard at Greenock being more particularly devoted to the building of steamers. Not only during the period when work was carried on in three yards, but later when operations were confined to the Kingston yard, the firm repeatedly occupied premier position in the annual returns of tonnage output. At first only provided with four berths the Kingston yard, through repeated extensions, has now thirteen berths, steamers of great dead-weight carrying capacity now being the leading productions. In 1894, on the dissolution of the firm, and the retirement from practical connection with shipbuilding of Mr. Joseph Russell, the east-end yard was taken over by Mr. Anderson Rodger—since vigorously carried on by Messrs. A. Rodger & Co.—while Mr. Lithgow remained sole partner at Kingston. Under his *regime* the business has since been carried on with remarkable energy and success, his abilities being as marked in the commercial as in the technical departments. Last year Mr. Lithgow's two sons were assumed as partners in the concern, and their training has been such as should secure a maintenence of the firm's prosperity and reputation. Although for most part absorbed in the management of business affairs, the deceased took a sincere, though unostentatious, interest in schemes for the welfare of Port Glasgow's inhabitants, and some years ago he gifted a sum of £10,000 for the clearing away of slums and the reconstruction on more sanitary lines of congested parts of the town. Mr. Lithgow is survived by his wife, who is a daughter of Mr. Henry Birkmyre, of the Greenock Ropeway Co., Port Glasgow, and by a grown-up family.

"IOLANDO."—Messrs. Davie & Horne, of Johnstone, near Glasgow, have in the engine room of the large steam yacht *Iolando*, built by Messrs. Ramage & Ferguson, the following fittings: evaporator and distiller with necessary pumps, filter and heater, and auxiliary winch condenser fitted with air and circulating pumps.

MESSRS. CONSTABLE are publishing a pocket volume which should be of great use to Marine Engineers. It is entitled "Handbook for the Care and Operation of Naval Machinery" and is written by Lieut. H. C. Dinger, of the U.S. Navy. The work has been designed to be suggestive and educational for the use of those engaged in the practical working of naval machinery, and especially for the requirements and needs of the petty officers and mechanics of the engineers' force on naval vessels. It will also prove a convenient manual of reference to all interested in the subject. There are numerous diagrams and other illustrations.

REVIEWS.

The Naval Annual, 1908. Edited by the Hon. T. A. Brassey. Portsmouth: J. Griffin. 1908.

In the introduction to the new issue of Brassey, the founder discusses the types of ships recently adopted for the British Navy. Comparing the efficiency of the *Lord Nelsons* and the *Dreadnoughts* he asserts that many naval officers would prefer to take the chances of battle in the *Lord Nelson* rather than in the *Dreadnought*. He further takes the opportunity of insisting on the desirability of smaller battleships for shallow waters—a plea which he has persistently urged for many years, and that in face of the universal adoption of the great battleship by all the maritime powers. For cruisers he contends that armour is essential under modern conditions, and would apparently divert the duty of scouting from vessels of the Royal Navy to the Atlantic liner, though at the present he considers that there remain in the lists of warships many vessels of good steaming powers, but of weak protection, to fulfil the duties of ocean scouts. He again repeats his belief that the country could do with a reduction in the numbers of the *personnel* on the peace establishment. The figures quoted in support of this view, though no doubt accurate, are apt to mislead, for whilst continental nations have conscription, we have voluntary service. They thus have proportionately larger numbers of trained men in their reserves than can ever be attained under our system. Thus it follows that we must make up for our want of reserves by the maintenance of a relatively larger establishment at all times. In his remarks on the progress of the British Navy the present editor refers to the remarkable increase in the size of the destroyer of to-day, and suggests that the time has come when such vessels as those of the "Tribal class" should be classified as torpedo-gun vessels rather than as destroyers. They have become too large and too costly for their original purpose—the destruction of torpedo boats. His remarks and figures as to the Board of Admiralty's policy in regard to new construction and to expenditure and on stores and repairs, though ostentatiously guarded, cannot fail to be unsatisfactory to those who, realizing Britain's dependence on the efficiency and sufficiency of her Navy, wish to see it maintained at a strength fully adequate to its responsibilities. We may draw attention in this connection to a remark on page 10 to the effect that there appears to be some doubt as to whether we can still claim to build much more rapidly than Germany—and thus goes one of the main arguments of those who attempted to defend the exiguous shipbuilding programme of 1908-9. He concludes by the observation that it is certain that expenditure on new construction and naval works must be largely increased next year, and indeed the truth of this statement is apparent from many of the facts and figures scattered throughout the book. For example, our readers may regard the summary of the new naval position in Germany as created by the amended law of 1908. There is one little point of comfort to us in the story. It is this. Though we seem to have lost our advantage in the possession of the means of building ships more rapidly than Germany, there is still a weak spot in her organization—the establishments which produce the materials for building battleships are not yet adequate to meet the increased demands now put upon them. There may therefore be some little delay in the completion of some of the ships now under construction. This fact may compensate for the loss of time which we on our side are enduring through the recent strike in the shipbuilding trade. But let us not trust too much to this. The German organizer will soon take care that the weak link in the chain of production is strengthened, and the producer will willingly extend his capacity for output, knowing that his Government will keep him fully and constantly employed, and thus provide him with an adequate return on his larger capital. An anonymous writer but one who, we fancy, has contributed to previous issues of the Annual—has an interesting and somewhat destructive criticism of the Admiralty's policy in building the great armoured cruisers of the *Invincible* class. Sir Frederick Pollock deals with the results—if there by any—of the second Hague conference, and Jack la Bolina has a chapter on the Naval and Maritime Industries of Italy. The attention of marine engineers will be largely attracted by the remarks of Mr. Alexander Richardson on "Experience with marine turbines." Some interesting and hitherto inaccessible results have been collected. They go to show that whether we regard coal consumption or the consumption of steam, turbine the engine shows marked economy over that of the reciprocating type. But it is not merely in these points that advantage is found, and further a popular belief to the effect that in heavy weather the turbine loses speed to a greater extent than the older type of engine is declared to be ungrounded. There are also afforded some interesting observations on the prospects of oil and gas engines at sea. Students of strategy will regard with interest Admiral Sir Cyprian Bridge's article on the share of the fleet in the defence of the Empire—a thoughtful contribution based upon close study of history and of our many mistakes in policy from the Crimean days onwards. The usual tables and diagrams of warships are afforded, whilst the third part, which deals with armour and ordnance and which was omitted from the 1907 volume, is restored to its old position, but under new direction. It is now in the capable and experienced hands of Commander Robinson. He duly chronicles many improvements which have been put afloat, including such aids to efficiency as the new types of sights and torpedoes. But perhaps at the moment one of the most important points of his contribution is the summary of results of inquiries made by him as to the extent of our capacity for the output of armour and ordnance. Whilst undoubtedly there has been great extension of plant for the augmentation of the output of these necessaries, it would seem that there may be a weak spot in the chain in regard to gun mountings—for it is said that even Elswick can only guarantee to deliver one turntable for 12-inch guns per month. As a dozen such guns seem likely to be the armament of the modern warship it will be seen that in spite of our many great shipbuilding yards and numerous shops for turning out marine engines, there is a limit to our powers of rapidly equipping new vessels. The usual appendices of Naval Estimates and other official papers are afforded, and it may be said in summing up that the present issue of the Annual will not only afford much instruction on the important naval questions of the day, but that it fully maintains its reputation as one of the most responsible and standard works of reference on naval affairs.

Technical Thermodynamics. By Dr. Gustav Zeuner. 2 vols. London. Constable & Co., Ltd. 26s.

The author, the well-known scientist, originally wrote on this subject as far back as 1859, the first edition of the present volumes, but in his after efforts, of which we have the translation now of the latest, the fifth, his aim has been always to give a bird's-eye view of the subject, and to this he attributes the favourable reception he has met with. It goes without saying that with such an author the work will be of the highest value. The difficulty of translation must be great and entail on the person undertaking it as much knowledge, perhaps, as the original writer possesses. The theories of light and heat, with the formulæ representing them, the properties of gases and their application, such as flow and efflux from one vessel to another, the work in heat and air engines under various conditions, are closely discussed here. This is followed by a setting forth of the principles underlying the Otto gas engine and Diesel motor.

The second volume opens with saturated vapours, and we have the relative values in temperature, the different pressures according to the liquid from which the vapour is derived. The total heat in the several cases is also shown, with specific weights. The properties of wet vapours are reasoned out, with application to steam and expansion in the cylinder, condenser and injector actions, and from dry vapours we are led on to superheated steam and the various gases used in refrigeration work. With the behaviour of saturated and superheated steam, the author expounds what a perfect steam engine should be and where losses occur. Cold vapour or refrigerating engines are treated in much the same way and the appendix is filled with tables of units of all kinds relating to the subject in hand. The two volumes are elaborate treatises and considerable mathematical knowledge is necessary to digest the contents.

The London Scaling Company inform us that they have removed their Offices from 101, Leadenhall Street, E.C., to No. 281, Victoria Dock Road, Custom House, London, E.

MESSRS. ARMSTRONG, WHITWORTH & CO., it has been reported, are meditating the establishment of branch works at Sydney, New South Wales, in order to put themselves in a position to build for the Commonwealth, warships, defence vessels and other work of a similar character. During the recent visit paid by Colonel Denny, Dumbarton, to New Zealand, views were advanced to the effect that his firm would be warmly welcomed in the Dominion if he and his partners could see their way to start a shipbuilding and engineering establishment, and build and engine steamers on the spot. A very high tribute was paid to Messrs. Denny and Co. by several writers and speakers in New Zealand in connection with the steamers built by the firm for the Union Company of New Zealand, and one of the outcomes of this was the thought and question which followed, why not build these fine steamers in New Zealand?

"PERSEUS."—On July 25th, Messrs. Workman, Clark and Co., Ltd., Belfast, successfully launched from their North Yard a screw steamer named the *Perseus*, built by them to the order of the Ocean Steamship Co., Ltd., of Liverpool (Messrs. Alfred Holt & Co., Ltd.). The new vessel is 460 feet in length, with a gross tonnage of 6,800, and is the first of two vessels that these builders have in hand for the same owners, the steamers being intended for their trade to the Far East. It is interesting to note that this is the seventeenth vessel built by this firm for the Ocean Steamship Company. Accommodation is arranged for a number of saloon passengers in state-rooms on the boat deck and for steerage passengers in the forecastle, while the after end of the main deck has been set apart for emigrants or Chinese pilgrims, separate lavatories and galleys being provided for each of these classes of passengers, while the matter of ventilation throughout the accommodation has received special consideration in view of the hot climate in which the vessel will be engaged. The four holds and 'tween deck spaces have been arranged so as to be free of obstruction by the adoption of the fore and aft girder principle of construction, so that consignments of the largest dimensions can be stowed with facility. Access to each hold is by large hatchways, each of which is efficiently furnished with powerful winches and suitable derricks and the appliances necessary for handling cargo. The propelling machinery comprises a set of triple-expansion engines, with all the necessary auxiliaries, supplied with steam from two double-ended cylindrical multitubular boilers, while an auxiliary boiler is provided for use in conjunction with the deck machinery.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class; 2C Second Class.

May 30th, 1908.

Agerskow, Chas.	2C	Hull
Alder, Percy ..	2C	Sunderl'd
Anderson, Jas.	2C	Greenock
Barrance, Chas.	2C	N Shields
Barron, Thomas	2C	N.Shields
Bradley, C. L.	1C	Sunderl'd
Brown, David..	2C	Greenock
Brown, Jos. T	2C	Liverpool
Cameron, D ..	2C	Sunderl'd
Carter, Fredk	2C	N Shields
Clouston, J S	1C	Aberdeen
Colling, P. B.	1C	Sunderl'd
Davies, P. W	2C	Liverpool
Davies, Wm J.	1C	Liverpool
Dickson, Arch.	2C	Greenock
Farquharson, J	1C	Aberdeen
Franklin, Geo	2C	N Shields
Freeman, Cecil	2C	N Shields
Frier; John D.	2C	London
Gibson, John ..	2C	London
Gilmour, D K	1C	Greenock
Gourlay, G. C.	1C	Greenock
Hedgecock, T.	1C	Hull
Hinchcliffe, W.	2C	London
Johnston, John	2C	Greenock
Lampard, F. C.	2C	Hull
Lewis, Wm N.	1C	Bristol
Logan, Jas S.	2C	Greenock
Macdonald, N C.	1C	Liverpool
Malabar, Saxon	2C	Liverpool
M'Culloch, S G	1C	Liverpool
Moore, Alex Y.	2C	Aberdeen
Padbury, W J	2C	London
Petrie, David C	2C	Aberdeen
Rawlinson, C.H	2C	London
Robson, D B	2C	Aberdeen
Rogers, Benj, J	1C	Liverpool
Ross, Alfred A.	1C	Aberdeen
Rudd, Albert ..	1C	N Shields
Russell, John ..	1C	N Shields
Smith, James ..	1C	Sunderl'd
Squire, Owen S.	2C	London
Swan, Herbert A	1C	London
Taylor, Harry	1C	Sunderl'd
Tillett, R. J ..	1C	London
Willis, Cecil N.	2C	London
Winchester, T.	1C	Aberdeen
Wright, Michael	2C	N.Shields

June 6th

Adams, Arth. G.	1C	Liverpool
Adamson, Geo.	2C	Glasgow
Barber, Jas. W.	1C	Liverpool
Barker, Wm. R.	1C	N.Shields
Barlow, H. A	2C	South'ton
Bement, H. C.	2C	Cardiff
Brand, Alex. ..	1C	Liverpool
Brown, Andrew	1C	Belfast
Brown, Peter A.	2C	London
Cassidy, Hugh	1C	Glasgow
Caw, J. J. M'G.	1C	Glasgow
Charlton, John	2C	N.Shields
Cleghorn, J. W.	1C	Leith
Cruckshank, J.S	1C	Leith
Davies, R W.	2C	South'ton
Duncan, John ..	2C	Leith
Ferguson, D ..	2C	Glasgow
Fotheringham, W.	1C	Belfast
Froster, Frank	2C	London
Garrett, D T.	1C	Cardiff
Gibson, James	1C	Belfast
Gleig, Stanley	2C	Liverpool
Goepel, Percy A.	1C	Glasgow
Gray, William	1C	Glasgow
Grindlay, J. S	1C	Glasgow
Guthrie, D G.	2C	Leith
Halliday, Joseph	2C	N.Shields
Hayes, Irwir B.	2C	Belfast
Hogg, Edgar G.	1C	N.Shields
Hudson, T. W.	1C	Liverpool
Hughes, Rich.	1C	Glasgow
Jenkins, Geo. H.	2C	Liverpool
Kennett, W. J.	2C	South'ton
Kilburn, C. E.	2C	South'ton
Lashmar, J. A	2C	South'ton
Liddell, Robert	2C	Leith
Lofthouse, M.H.	2C	Glasgow
Mackenzie, C...	2C	Cardiff
Mackenzie, H.	2C	London
Martin, William	2C	Glasgow
M'Farlane, J. R.	2C	Glasgow
M'Gilp, John ..	1C	Glasgow
Milne, Alfred ..	2C	Glasgow
Powell, Rhys ..	1C	Cardiff
Rees, Alfred C.	2C	Cardiff
Roberts, A. C.	1C	Liverpool
Russell, Donald	2C	Glasgow
Savings, Daniel	1C	South'ton
Simpson, A. E.	2C	Liverpool
Tedford, Wm.	1C	Glasgow
Thompson, D.R.	2C	London
Tubbs, A. E. ..	1C	South'ton
Williams, D. K.	1C	Liverpool
Williamson, J.D.	1C	Leith

June 13th.

Austin, John T.	2C	Greenock
Balbirnie, Robt.	2C	Liverpool
Barham, R. G	2C	N.Shields
Brown, Matthew	2C	N.Shields
Bruce, James M.	1C	Liverpool
Campbell, James	2C	Greenock
Carroll, Percy J.	2C	Liverpool
Coulton, G. H.	1C	Liverpool
Crawford, R B	2C	London
Cuff, Fred C ..	2C	London
Davison, J. W	2C	N.Shields
Donkin, D. D	2C	N Shields
Evans, John C.	1C	Liverpool
Finney, Ed. B.	2C	London
Foster, G A J.	1C	Hull
Gibson, Geo. H.	1C	N.Shields
Haigh, H. W...	2C	Hull
Halladay, Geo.	1C	N.Shields
Halliday, J. W.	2C	London
Harrop, G. T...	2C	Liverpool
Henderson, John	1C	N.Shields
Hepburn, W J.	1C	Liverpool
Heselton, T. A.	2C	Hull
Howarth, Abm.	1C	London
Huntley, G. W.	2C	N.Shields
MacDonald, A.	1C	Liverpool
Mackay, Robert	2C	Greenock
Matthew, W W.	2C	London
M'Cann, Jos. A	1C	Liverpool
M'Graa, Jos S	2C	Liverpool
Mitchell, W. G.	1C	Liverpool
Murray, Leon C.	2C	Hull
Murray, T. C.	2C	Greenock
Ogden, P. E. C.	2C	London
Palmer, Allen G.	2C	London
Parkinson, F...	1C	N.Shields
Petty, James M.	2C	Hull
Phillips, R. H.	2C	N.Shields
Plimmer, I. H.	2C	London
Railton, Geo. B.	1C	Liverpool
Smart, Geo. R	1C	Dundee
Steel, John H.	2C	Liverpool
Steuart, Alex...	1C	Liverpool
Stewart, J. A. G	2C	Greenock
Stobo, John ..	2C	Greenock
Tennent, W. W.	2C	Greenock
Wolfe, W. C. ..	1C	Liverpool
Young, James..	2C	Greenock

June 20th.

Abbott, Robert	2C	Glasgow
Allan, David D.	1C	Leith
Archer, C. S. ..	2C	London
Benattson, E.H.	2C	W. Hart'l
Bishop, H. C. G.	1C	London
Black, A. R ..	2C	Leith
Blackmore, I...	1C	Cardiff
Bone, Fredk. W.	1C	London
Bray, Percy R.	2C	Cardiff
Brooks, R. W.	2C	Liverpool
Carey, Robert..	2C	Cardiff
Carlisle, H M	2C	Barrow
Carstairs, A. ..	2C	South'ton
Catton, Robert	2C	London
Colville, David	1C	Glasgow
Coulson, Thos.	1C	W. Hart'l
Creighton, E. H.	1C	Barrow
Crook, Harry ..	2C	Liverpool
Edmunds, H. ..	1C	Cardiff
Fallows, Fredk.	1C	Liverpool
Finney, John B.	1C	W. Hart'l
Fleming, Wm.	1C	Liverpool
Graham, James	2C	Glasgow
Green, Andrew	1C	Glasgow
Grossan, G. W	1C	Glasgow
Gunn, George ..	1C	Glasgow
Hemingway, A.	1C	Cardiff
Heyes, Thos. G.	1C	Liverpool
Holdforth, E H	2C	W. Hart'l
Houston, Adam	2C	W. Hart'l
Howat, T. H. M.	2C	Glasgow
Hunter, John ..	2C	Glasgow
Hynd, Geo. L.	2C	South'ton
Jamieson, J C.	2C	London
Jones, Evan J.	1C	Cardiff
Jones, Griffith..	1C	Cardiff
Jones, James ..	1C	Barrow
Jones, Thomas	2C	Liverpool
Leveson, Walter	2C	Cardiff
Lindsay, John S	2C	South'ton
Marr, Arthur G	1C	Leith
Miller, Lionel A.	2C	London
M'Intyre, A B	2C	London
Montgomery, D.	2C	Glasgow
Moodie, Jas. S.	2C	Leith
Morgan, Geo. V.	2C	Cardiff
Morrison, Philip	2C	Glasgow
Morton, Jas. J.	1C	Glasgow
Noel, Wm. F. F.	2C	South'ton
Osborne, W. F	2C	Glasgow
Priestley, C. G	2C	Cardiff
Redfern, N R.	2C	Liverpool
Roberts, Samuel	2C	Liverpool
Rutherford, H.	1C	W. Hart'l
Seabourne, S...	1C	Cardiff
Sievewright, G.	2C	Leith
Simpson, J. R.	2C	Glasgow
Smith, David ..	2C	Leith
Symon, Wm P.	2C	Leith
Thompson, H.J.	1C	Liverpool
Thornton, J. J.	1C	W. Hart'l
Todd, John	1C	W Hart'l

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